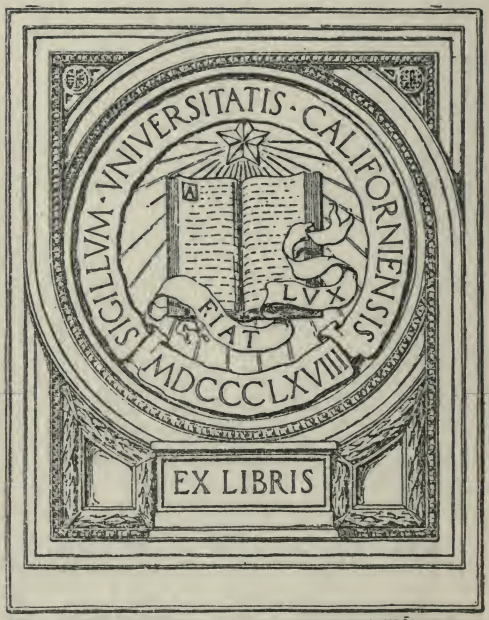
QA
102
W425

UC-NRLF

$B 278 942

YB 17446

IN MEMORIAM
Professor J. Henry Senger



[Wentworth, G. A.

ANSWERS

TO

WENTWORTH AND HILL'S

ARITHMETIC.

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In Memoriam
Prof. J. Henry Senger

WENTWORTH'S
SERIES OF MATHEMATICS.

First Steps in Number.
Primary Arithmetic.
Grammar School Arithmetic.
High School Arithmetic.
Exercises in Arithmetic.
Shorter Course in Algebra.
Elements of Algebra. Complete Algebra.
College Algebra. Exercises in Algebra.
Plane Geometry.
Plane and Solid Geometry.
Exercises in Geometry.
Pl. and Sol. Geometry and Pl. Trigonometry.
Plane Trigonometry and Tables.
Plane and Spherical Trigonometry.
Surveying.
Pl. and Sph. Trigonometry, Surveying, and Tables.
Trigonometry, Surveying, and Navigation.
Trigonometry Formulas.
Logarithmic and Trigonometric Tables (*Seven*).
Log. and Trig. Tables (*Complete Edition*).
Analytic Geometry.

Special Terms and Circular on Application.

QA102
W425

ANSWERS.

Art.
45. 995;
398.8;
488.92;
1689.91.
46. 1707.8;
3271.1;
1945.66;
3440.4;
2018.44;
8440.75.
47. 2372.64;
8794.95;
3625.3;
2299.86;
2062;
1897.8236;
1900.01828.
48. 6.64528;
30,106.937;
2284.57828;
371.8273.
49. 848.87;
1748.87;
3041.87;
959.87;
1000.87;

Art.
49. 1110.87;
1000;
1299.07;
770.22;
1342.17.
50. 886.353;
950.998;
347.0759;
724.8363;
1694.6084.
52. 6.6452727;
7.7847491;
10.6313239;
20.8266782;
1.2272041;
1.2099648.
53. 1.30103;
4.5861528;
3.5282304;
19.0826303;
16.5414467;
6.0157063;
4.2070434;
5.2839031;
3.2384788;
8.485051;

Art.
53. 1.2626906;
6.3834733.
54. 7.603166;
11.4093504;
6.7286717;
10.528675;
3.2657244;
21.712055;
19.9922991;
22.6276131;
20.0826303.
55. 4.523467;
14.8237261;
22.1157111;
24.8583194;
10.2590772;
29.6490831.
57. 1448.95;
2393.60;
1870.27;
2956.89;
4267.58;
3950.41;
6570.39;
3501.93;
4064.96.

M43594

Art.
69. 3; 3;
7; 3;
3; 9;
14;
22;
22.
70. 40 mi. N.;
$4.
73. 111;
220;
301;
432;
553;
602;
716;
876;
877;
9978;
4997.
74. 333;
423;
522;
5922;
6399;
6397;
7341;
6550;
3086;
3878;
9334;
2999.
75. 195;
119;
1822;

Art.
75. 1802;
314;
51;
118;
2482;
15,545;
1388.
76. $106.98;
$87.69;
$97.87;
$141.73;
$23.50;
$118.46;
$307.92;
$26.38.
77. 7066;
6975;
7287;
2848;
1747;
7276;
6987;
6960;
7391;
3251.
78. 0.4233109;
0.2617994;
4.3761829;
2.1462729;
0.088907;
2.976072;
1.6715398;
3.1636232;

Art.
78. 15.1683487;
0.3178372;
1.854102;
0.317004;
0.5040172;
1.618034;
0.080936.
79. 2.3561945;
1.5707963;
0.7853981;
2.6179939;
2.0943951;
1.5707963;
1.0471975;
0.5235987.
80. 0.618034;
0.7961796;
1.
81. 46.
82. 19,418.
83. 382.
84. 46.
85. 329.426.
86. 4615.71.
87. 115,946.
88. 182,741.
89. 3822.161.
90. 1,107,790.
91. $501.02.
92. $72.17.
93. $235.56;
$180.37.
94. 66 yrs.;
45 yrs., 11 mos., 30 days.

Art.
95. 73;
115;
128;
116;
264;
284;
297;
320;
354;
369.
96. 58, (59);
89, (90);
88, (89);
241, (242);
180, (181);
121, (121).
97. 1, 2;
2, 3;
3, 5;
4, 4;
2, 6;
1, 7.
98. 6689;
8334.68.
99. 7.9585202.
100. 0.80415828
101. 609 gals.
102. 12;
17;
13.37;
15.8958;
100.
103. 0.5;

Art.

103. 0.47;
0.468;
0.4764;
0.4764012.

104. 3005;
2494;
1997;
1484;
428;
939;
1436;
1949.

105. 31,385.

106. $3.15.

107. $8138.25;
$7245.75.

108. A.D. 899;
A.D. 1087;
B.C. 399;
B.C. 347;
B.C. 382;
A.D. 70.

109. James, 1 more.

116. 555;
369;
462;
342;
1684;
2560;
17,312;
7122;
14,256;
58.009;
28.8594;

Art.

116. 439.726;
74.2064;
469.206.

117. 3.1415928;
3.1415928;
78.53981625.

118. 34.5576;
37.6992;
40.8408;
43.9824;
47.124;
24.596748;
29.068884;
38.013156;
38.013156;
40.249224;
42.485292.

120. 31.4159265;
314.159265;
3,141,592.65;
$37.50;
$21.70;
$58.75;
$375;
$217;
$587.50;
$337.50;
$512.50.

122. 0.236;
0.0236;
0.00063;
0.078;
0.00431;
0.002331;

Art.

122. 0.0065;
0.00012.

123. $98.10;
$320.60;
$608.40;
$784;
$1028.40.

124. $0.83625;
$19.5125;
$0.250875;
$4.73875;
$0.529625;
$3.62375;
$22.30;
$23.13625;
$0.39025.

125. 262.5;
5467;
2355;
0.48825;
523,456;
9.321102.

129. 1.570796;
15.70796;
2.356194;
235.6194;
3.92699;
0.392699;
0.00392699;
578.838326;
5.78838326;
672.300688;
67.2300688;
0.0672300688;

Art.

129. 7.85398;
786.183398;
0.786183398;
749.269692;
0.00749269692.

130. 215.042;
2.15042;
1612.815;
161.2815;
178.48486.

131. 0.98994952;
0.9998490152;
0.99999043656;
1.0000003360552;
1.979894;
1.999975782;
2.0000040662;
2.999824;
4.99985252;
381.924;
0.38196664319;
0.61803335681.

133. 63,231.52;
654.6528;
450.8847;
309.89508.

134. 2,914,700;
278,560;
99.9999;
7854.

135. 1584;
3696;
897.6;
3025.44;

Art.

135. 4466.88.

138. 7.77546;
0.777546;
0.0777546;
52.20292;
5.230204;
5.167932;
82.8089;
8532.7315.

139. 90.85041;
230.52519;
4.6723068;
5.5190079;
6.1370379;
3.136364;
4.183564;
4.7108292;
366.509528.

140. 0.4853772;
0.3000228;
0.61685316;
0.2371908;
1.679724;
1.038276;
2.1347172;
1.649826.

141. 34.109316;
20.103747;
2.296;
4.74165;
11.647195;
0.110999;
8.362134;
74.538.

Art.

144. 7.02460;
20,000,001.06;
0.381966;
5000.000;
3000.00.

147. **1.** $626;
$624;
$628;
$626.

2. 1346.

3. 16.011 bu.

4. $52,976,000.

5. 767,340.

6. 252,321.5.

7. $73.20.

8. $43.42.

148. **1.** 7^8; 8^3;
2^9;
5^6.

2. 3.01^3;
0.67^{10};
0.208^4.

3. 2.003^6;
20.03^4;
20.03^3.

153. 321;
423;
282;
141;
212;
10.41;
12.004;
1.21;
0.144.

Art.

158. 1. 0.04286;
0.000027;
36,666.66667.

2. 23.33333;
1571.42857;
18.57143.

3. 24.28571;
0.00064;
0.01182.

4. 0.01545;
0.05833;
0.0025.

5. 91.66667;
1.41667;
14.16667.

6. 2266.66667;
1133.33333;
0.12364.

7. 320;
32;
3.2.

8. 0.032;
1.17778;
0.00012.

160. 1. 3.35977;
1.75499;
94.66644;
184.98040.

2. 1.76470;
1.73410;
1.73210;
1.73200.

3. 0.0000254;

4. 1.41423;

Art.

160. 4. 2.23613.

165. 1. 2.

2. 684.

3. 1095.

4. 330.

5. 236.4.

6. 6048.

7. 6700.

8. 30.12.

9. 0.9072.

10. 44.1.

11. 215,240.

12. 8516.6.

13. 217.

14. 3040.

15. 259.

16. 324.

17. 22.5.

18. 33.75.

167. 1. 2;
4;
5;
0.5;
0.4015;
0.90202.

2. 0.70710.

3. 0.70710.

4. 3.14159;
0.31831.

5. 0.54023;
0.60919;
0.5;
0.33333.

6. $1\frac{194}{393}$;

Art.

167. 6. $19\frac{130}{181}$;
$\frac{1}{8}$;
0.5.

7. 2;
$2\frac{98}{171}$;
$\frac{1}{2}$;
0.1126;
0.01;
0.00011.

168. 1. 3.637813.

2. 0.00129.

3. 2.030.

4. 0.00007294.

5. 38.144.

6. 0.00005677.

7. 6120.968.

169. 1. 1;
10;
100;
1000;
10,000;
100,000;
1,000,000.

2. 1;
$\frac{1}{10}$;
$\frac{1}{100}$;
$\frac{1}{1000}$;
$\frac{1}{10000}$;
$\frac{1}{100000}$;
$\frac{1}{1000000}$;

3. 1;
1;
1;
1; $\frac{1}{10}$.

Art.

169. **4.** 10,000; $\frac{1}{10000}$; 100; 100.

5. $\frac{1}{10}$; 10; $\frac{1}{100000}$; 10.

6. 10; $\frac{1}{10}$; 10; 1.

7. 1.030301; 1.01; 0.99009.

Exercise I.

Page 63.

17. 73.603891.

18. 1426.8527.

19. 61.942.

20. 11.5111; 7.51917.

21. 19.0554; 21.8365.

22. 24.7183; 0.8531.

23. 0.45763; 99.99824.

24. 8.5125.

25. 24.9914.

Page 64.

26. 20.6445; 0.2412; 0.0224.

27. 10.30005; 241.46387; 0.01004.

28. 0.000006; 453.646; 0.43104.

29. 0.343; 0.03555.

30. 1.13925.

31. 9.0601; 0.002025; 0.00006561; 132.682214448064; 0.438976.

32. 0.000512.

33. 48.64; 0.01078; 8.8089.

34. 149.7; 3.593; 7557.

35. 10.932; 0.4575; 2760.

36. 39,840; 1000; 10,000,000.

37. 0.02295; 2.25; 0.1794.

38. 11,875; 2894.53125; 7.8125.

39. 0.10720; 20.41482; 0.17857.

40. 0.06905; 58,257.40365; 338,983.05084.

Exercise II.

1. 7.375.

2. 6.

3. 10.

4. 5.555.

5. 1.

6. 5.

7. 20.

8. 9.

9. 0.06.

10. 0.202272.

11. 0.0078.

12. 0.00112914.

13. 3.

Page 65.

14. 13.
15. 19.04.
16. 120.
17. 0.0505.
18. 0.00046.
19. 0.0003593.
20. 0.7557.
21. 0.010932.
22. 0.00004575.
23. 2760.
24. 116.
25. 2.52.

Exercise III.

1. 909.
2. 42.
3. 935.
4. 2.27083 mi.
5. 3.4167 hrs.
6. 21.36288; 6.36618.
7. 96.248 in.
8. 336.13445.

Page 66.

9. 350.25 lbs.
10. 260,078.
11. 601.
12. $2184.91.
13. 4032; $3.24.
14. $5934.
15. 61.
16. 37.56097 min.; 49.67741 min.
17. 8857.98276 min.
18. 14,925.37313.
19. $31.45.
20. $196.80.
21. 66,662.97.

Page 67.

22. 8590.10270.
23. 7.48051; 9.30917; 1.24445; 3.38375.
24. $8383.67.
25. 7068.
26. 3 dys.; 6 dys.; 6 dys.
27. H., $0.54; T., $0.90; R., $0.36.
28. B., $46.36; C., $41.48.
29. $63.20.
30. 420; 50.
31. 6000.
32. 24,780 lbs.; 25,620 lbs.

Page 68.

33. 708 lbs., dry; 732 lbs., wet.
34. 15.245 cu. in.; 113.34863 lbs.
35. 1.81357.
36. 7.49064.
37. 7.50334.
38. 11,190,000 mi.; 18,011,400^{km}.
39. 671,400,000 mi.; 1,080,684,000^{km}.
40. 449.43724.
41. 431.03448.
42. 0.2178.

Page 69.

43. 39.3708.
44. Divided by 2.
45. It is increased by two times the number; not any.

46. It is multiplied by the square of the number; not any.

47. It is multiplied by the number; it is divided by the number.

48. 1.21 sec.; 343.4 sec.; 2470.6 sec.; 14,270.5 sec.; 475.3 sec.; 723.4 sec.; 4528.7 sec.; 77,469,335 sec. 183.7 sec.; 1291.1 sec.; 9093 sec.;

49. Earth, 91,501,150; Asteroids, 248,560,000; Mercury, 35,357,660; Jupiter, 475,619,560; Venus, 66,116,960; Saturn, 871,824,200; Mars, 139,255,740; Uranus, 1,750,483,800; Neptune, 2,747,209,400.

Page 73.

1. 5.427^{km}; $5,427,000^{mm}$; $542,700^{cm}$.

2. 6.853^{m}; 685.3^{cm}; 0.006853^{km}.

3. 4970^{cm}; $49,700^{mm}$; 0.0497^{km}.

4. $1,240,000^{cm}$; $12,400,000^{mm}$.

5. 1.23^{km}; $123,000^{cm}$.

6. 12.30^{m}; $12,300^{mm}$.

7. 172.718^{m}.

8. 862.05^{m}; 0.00083^{m}.

9. 365.6^{m}; 1.852272^{m}; 0.364896^{m}.

10. 391.94845^{m}; 16^{m}.

11. $11.59.

12. $45.

13. 42.05^{m}.

14. $3.12.

15. $0.014.

16. 533.33^{m}.

17. 0.07.

18. $147.

Page 75.

1. 185.4276^{ha}; 1.854276^{qkm}.

2. 278.56^{ha}.

3. $17,431^{qcm}$; $1,743,100^{qmm}$.

4. 174.675^{qkm}.

5. $1,361,400^{qm}$.

6. $22,500^{qm}$.

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7. 137^{qcm}.

8. 357.1^{qmm}.

Page 77.

1. $2,250,000^{ccm}$.

2. 2.162875^{cbm}.

Page 78.

1. 1700^{l}; 157.854^{l}.
2. 9500^{ccm}; 15^{ccm}.
3. $125{,}000^{ccm}$; 0.125^{cbm}.
4. 4.3188^{hl}; 0.43188^{cbm}.
5. 375^{l}; $375{,}000^{ccm}$.
6. 734.159651^{l}; 7.34159651^{hl}; 0.734159651^{cbm}.
7. 8.573412867^{cbm}.
8. $734{,}578.912^{ccm}$; 734.578912^{l}.
9. 1.7315^{cbm}; $1{,}731{,}500^{ccm}$.

Page 79.

1. 1730; 341.
2. 100.
3. 13.756^{g}; 0.013756^{kg}.
4. 346.1^{g}.
5. 376.15^{kg}.
6. $677{,}800^{mg}$.
7. 5800.

Exercise IV.

Page 80.

1. 109.59^{m}.
2. \$254.12.
3. 57.625^{m}.
4. 3.437^{m}.
5. 11.282^{km}.
6. 3312^{km}; 2860^{km}; 1600^{km}; 3180^{km}.
7. 5527.9^{km}; 6712.45^{km}; $15{,}478.12^{km}$; $21{,}953.66^{km}$; $288{,}240.5^{km}$.
8. \$4.11; \$14.15.
9. \$113.63; \$229.17.
10. \$745.88.
11. \$64.88.
12. \$128.50.
13. \$968.50.
14. \$47.32.

Page 81.

15. 3.1416^{m}.
16. $260{,}752.8^{mm}$; $11{,}655.3^{mm}$; $103{,}044.5^{mm}$; 326.7^{mm}; 370.7^{mm}; 525.0^{mm}; 123.5^{mm}.
17. $925{,}142{,}191{,}327^{m}$.
18. $40{,}005.1344^{km}$.
19. 4.1155^{m}; 4.1155^{m}; 69.9635^{m}.
20. 17 nearly; 18 nearly; 4197 nearly.
21. 0.31831.
22. 100^{cm}.
23. 1.7507^{m}.
24. 0.94538^{m}.
25. 636.62^{m}.
26. 6.3662^{cm}.
27. 23.87325^{m}.

Exercise V.

Page 82.

1. 323^{qcm}.
2. $11,200^{ha}$; $11,144.659^{ha}$.
3. 14.222^{ha}; 14.166^{ha}.
4. 0.169^{ha}.
5. 15.639^{qm}; 33.914^{qm}; 40.152^{qm}.

Page 83.

6. 2.49126761^{ha}; 2.4909024^{ha}; 2.4907176^{ha}; 7.47288761^{ha}.
7. \$168.16; \$168.14; \$168.12; \$504.42; \$956.66; \$956.51; \$956.44; \$2869.60; \$59,167.61; \$59,158.93; \$59,154.54; \$177,481.08.
8. 572.5566^{qcm}; 0.7854^{qm}.
9. 48.275^{ha}.
10. 754.7694^{qcm}.
11. 18^{cm}; 36^{m}.
12. 468^{qm}; 300^{qm}.

Page 84.

13. 153.9384^{qcm}.
14. 1017.8784^{qcm}.
15. 199.5119^{qm}.
16. 226.1952^{qcm}.
17. 7696.92^{qcm}.
18. 48.275^{ha}.
19. 153.9384^{qcm}.
20. 1.505^{qm}.
21. 1809.5616^{qm}.
22. 5026.56^{qm}; 706.86^{qm}; 4319.7^{qm}.

Page 85.

24. 99.84^{m}.
25. 54^{m}.
26. 43.76^{m}.
27. 25^{m}; \$46.88.
28. 33.25^{m}; \$70.66.
29. 44.8^{m}; 40^{cm}; \$56.

Page 86.

31. 19.
32. \$35.
33. \$73.88.
34. \$14.
35. \$36.14.
36. \$19.95.
37. \$43.20.

Page 87.

38. \$120.
39. \$234.60.
40. 1.6.
41. 3.75.
42. 96.
43. 5.5.
44. 72; \$18.
45. 42; \$5.88.

Page 88.

46. \$1.49. **48.** \$7.56. **50.** \$3.85. **52.** \$55.20.
47. \$19.22 **49.** \$0.97. **51.** \$129.02. **53.** \$118.04.

Exercise VI.

Page 89.

1. 378^{ccm}. **2.** 73.416^{s}. **3.** 1375.6064^{hl}. **4.** $111,424.1184^{kg}$.

Page 90.

5. \$4258.69.
6. 1079.757^{l}; 1079.757^{kg}.
7. $445,341^{ccm}$; 445.341^{l}; 4.45341^{hl}.
8. 280.68^{hl}; 173.086^{hl}; 364.884^{hl}.
9. 2.3701^{m}; 9.2201^{hl}.
10. 298.452^{ccm}.
11. 0.785^{l}.
12. 4.132^{l}; 0.392^{l}.
13. 523.6^{ccm}; 0.0012^{ccm}.
14. 3811.2^{ccm}, or 3.8112^{l}.

Page 91.

15. 1749.561^{l}, or 17.49561^{hl}.
16. $145,782^{l}$.
17. 223.42 min.
18. 40.459 min.
19. 0.903178^{cbm}.

Exercise VII.

1. 100^{kg}; 73.8^{kg}; 1000^{kg}; 0.001^{kg}.
2. \$5.
3. 264.404^{kg}.
4. 274.980^{kg}.
5. 259.380^{kg}.
6. 955.24^{kg}.

Page 92.

7. 7235^{kg}, or 7.235^{t}; 8464.95^{kg}, or 8.46495^{t}.
8. 28.75^{kg}.
9. 24.
10. 363.33^{mg}.

Exercise VIII.

Page 93.

1. 0.833.
2. 678.11^{kg}.
3. 79.249^{kg}; 79.443^{kg}; 79.831^{kg}; 81.286^{kg}; 82.159^{kg}.
4. 64.1806^{g}; 66.6779^{g}.

Page 94.

5. 2.608.
6. 5.1635^{kg}.
7. 12.242^{kg}; 12.215^{kg}.
8. 8.953.
9. 7.309; 283.615^{kg}; 295.765^{kg}.
10. 1.0258; 1.0257.
11. 4.315.
12. 1.723; 2.098.
13. 7.3.
14. 2.317.
15. 2.789.
16. 3.04.

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17. 17.8^{ccm}; 1.893.
18. 13.616; 13.588; 13.592; 13.599.
19. 7.5.

Exercise IX.

1. 2.67^{kg}; 18.67^{kg}; 1.14^{kg}; 0.38^{kg}; 2.67^{kg}; 18.67^{kg}; 93.33^{kg}.
2. 161.5^{kg}.
3. 20^{l}; 140^{l}; 3740^{l}.
4. 40^{l}; 13.33^{l}; 560^{l}.
5. 90^{l}; \$4.44.
6. \$0.06; \$0.065.

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7. \$11.50.
8. 7.
9. \$26.25.
10. 11.2 min.
11. 6.588 min.
12. 2.4984 dys.
13. 40 min.
14. 2.533^{l} a min.
15. 265.26.
16. 61 times.
17. 852.6^{kg}.
18. \$159.86.

Exercise X.

Page 97.

1. $46{,}609^{m}$.
2. 5013.
3. 840.
4. \$2,876,626.20.
5. \$900,662.50.
6. \$23,062,338; \$7,391,775.
7. 41.145^{m}.
8. 12.16^{m}.
9. 0.028^{cm}.
10. 2304.338^{km}.

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11. 6.24^{km}.
12. 19,277.2.
13. 100^{ha}; $10{,}000^{a}$; $1{,}000{,}000^{qm}$.
14. $54{,}200{,}000^{ha}$.
15. \$20,991.60.
16. 716.
17. 1690.
18. \$0.136.
19. \$300.
20. $0.997^{2} \times 14.0715^{ha} = 13.987^{ha}$.

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21. 121,000; 181.5^{hl}.
22. 0.283608^{a}.
23. 14.6965^{s}.
24. 0.15869^{cbm}.
25. 10.547^{m}.
26. 5250^{l}; 2.38^{m}.
27. 3.646^{cbm}.
28. 196.
29. 1.6387^{cbm}.

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30. 4200.
31. 1372.55^{hl}; \$4952.50; \$148.58.
32. 1331^{ccm}; 18,782.
33. 29.532^{cbm}.
34. 1.273^{kg}.

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35. \$0.602.
36. 3243.
37. 0.0434578^{kg}.
38. 1.911^{t}.
39. 1.16^{ccm}; 0.14^{ccm}; 0.088^{ccm}; 0.113^{ccm}; 0.095^{ccm}; 4.167^{ccm}.
40. \$0.548.
41. \$1.48.
42. 9^{m}.
43. 0.86207^{m}.
44. \$8.
45. 6.06^{ccm}.
46. 154.943^{qcm}.
47. 32.5624^{kg}.

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48. 33.696^{kg}.
49. 18,966.
50. 0.4615^{cbm}; \$14.28.
51. 3624.145^{kg}.
52. 258.74^{l}; 12.
53. 20.48^{cbm}.
54. \$993.30.
55. 56,000.
56. 101.118^{l}.

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57. 67.259^{kg}; 16.72^{cm}.
58. 7; 5^{l}.
59. 0.42568^{cbm}; \$0.518.
60. 6.603^{m}.
61. 10,472^{l}.
62. 666.37^{qm}.
63. 0.032^{mm}.
64. 1.264; \$2,173,913.04.

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65. 3846.15^{m}.
66. 1128.7878^{kg}.
67. 1194; \$188.81.
68. 0.89079^{l}; 434.21^{g}.
69. 196.875^{kg}.

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70. \$71.96; 1504.11134^{kg}.
71. \$0.28.
72. \$25,608.96.
73. 83.333^{m}.
74. \$0.191.
75. \$1378.13.

Exercise XI.

Page 110.

1. $2 \times 2 \times 37$;
$2^3 \times 3 \times 11$;
2×89; 3×61;
1×173; 11×17;
2×173; $7 \times 7 \times 7$.

2. $2 \times 3 \times 5 \times 7$;
1×353;
$2^5 \times 3 \times 5 \times 11$;
$3 \times 7 \times 11$;
$2^3 \times 3 \times 7 \times 11 \times 17$;
37×37;
$2^3 \times 3^2 \times 19$.

3. 13×19; 3×109;
1×179; 1×83;
$5^3 \times 17$;
13×181;
1×2333.

4. $3 \times 5 \times 11$;
$2^3 \times 3 \times 7$;
$2^2 \times 3 \times 179$;
$2 \times 3 \times 2777$;
3×107;
$3 \times 11 \times 47$;
2×19.

5. 2×41;
3×43;
$2^3 \times 3^2$;
$2 \times 3 \times 11$;
$2^2 \times 17$;
5×13;
$2^2 \times 19$;
2×43;
$2^3 \times 11$;
2×71;

6. 2×163; $2^4 \times 23$;
$2^4 \times 29$; $2^2 \times 73$;
2×181; 5×73;
$2 \times 5 \times 73$;
$2 \times 3 \times 7$.

7. $2^2 \times 7 \times 31$; $3^3 \times 37$;
$2 \times 3 \times 137$;
2×673; $3^3 \times 283$;
$2 \times 3 \times 1039$;
$2 \times 3^2 \times 13$;

8. 3×193; 1×577;
$2^2 \times 53$; $2 \times 3^2 \times 7$;
2^7; 2^{13};
$2 \times 3^2 \times 5 \times 7 \times 13$.

9. 7×1171;
5^5; 7^4; 11^3;
$3^2 \times 7 \times 11 \times 113$;
$3 \times 7 \times 11 \times 109$.

Exercise XII.

1. $2^2 \times 3 \times 7 \times 0.1$;
$2^2 \times 19 \times 0.1$;
$2^2 \times 3^3 \times 0.01$;
$2^4 \times 3^2 \times 0.001$;
$2^2 \times 3^2 \times 0.001$; 37×0.001;
$3 \times 5 \times 11 \times 13 \times 0.01$.

2. $2 \times 73 \times 0.1$;
$3^2 \times 29 \times 0.01$; $2^2 \times 53 \times 0.1$;
$2 \times 3 \times 7 \times 11 \times 17 \times 0.01$;
$2^2 \times 7 \times 11 \times 17 \times 0.0001$;
$2^2 \times 13 \times 0.00001$.

3. $3 \times 17^2 \times 0.01$;
$3 \times 7 \times 23 \times 0.1$;
$3^2 \times 11 \times 101 \times 0.01$;
$2^3 \times 3^2 \times 7 \times 0.01$;
$3^3 \times 5 \times 11 \times 0.001$;
$2^3 \times 3^3 \times 0.001$.

4. $11 \times 317 \times 0.01$;
$2^2 \times 3^4 \times 0.1$;
$3 \times 5 \times 11 \times 31 \times 0.001$;
$2^3 \times 89 \times 0.1$;
$41 \times 73 \times 0.001$.

Exercise XIII.

Page 112.

1. 3.	**7.** 2.	**12.** 14.	**17.** 6.	**22.** 11.
2. 13.	**8.** 3.	**13.** 12.	**18.** 14.	**23.** 21.
3. 4.	**9.** 5.	**14.** 21.	**19.** 16.	**24.** 16.
4. 9.	**10.** 14.	**15.** 4.	**20.** 24.	**25.** 17.
5. 27.	**11.** 6.	**16.** 9.	**21.** 42.	**26.** 101.
6. 2.				

Exercise XIV.

Page 115.

1. 37.	**5.** 135.	**9.** 809.	**13.** 97.	**17.** 1.
2. 105.	**6.** 352.	**10.** 113.	**14.** 93.	**18.** 56.
3. 8.	**7.** 345.	**11.** 127.	**15.** 108.	**19.** 387.
4. 151.	**8.** 107.	**12.** 99.	**16.** 59.	**20.** 2138.

Exercise XV.

Page 116.

1. 57.	**3.** 247.	**5.** 107.	**7.** 37.	**9.** 111.
2. 23.	**4.** 327.	**6.** 449.	**8.** 119.	**10.** 227.

Exercise XVI.

Page 118.

1. 42.	**11.** 297.	**21.** 630.	**31.** 288.	**41.** 7560.
2. 24.	**12.** 1001.	**22.** 32,400.	**32.** 36,036.	**42.** 2400.
3. 30.	**13.** 385.	**23.** 780.	**33.** 3570.	**43.** 32,844.
4. 36.	**14.** 432.	**24.** 3600.	**34.** 5040.	**44.** 40,480.
5. 105.	**15.** 660.	**25.** 600.	**35.** 27,324.	**45.** 23,400.
6. 120.	**16.** 7920.	**26.** 210.	**36.** 2340.	**46.** 576,576.
7. 168.	**17.** 6720.	**27.** 2520.	**37.** 27,720.	**47.** 181,875.
8. 60.	**18.** 1296.	**28.** 2310.	**38.** 228,150.	**48.** 50,592.
9. 96.	**19.** 1800.	**29.** 756.	**39.** 13,800.	**49.** 29,029.
10. 231.	**20.** 4704.	**30.** 6630.	**40.** 2736.	**50.** 10,241.

Exercise XVII.

Page 119.

1. 4664.
2. 11,803.
3. 141,036.
4. 41,123.
5. 23,069.
6. 27,869.
7. 92,796.
8. 14,385.
9. 5967.
10. 61,318.
11. 7,577,304.
12. 12,397.
13. 164,808.
14. 3,295,313.
15. 260,117.
16. 37,219.
17. 163,601,937.
18. 250,641,677.
19. 34,573.
20. 79,781.

Exercise XVIII.

Page 122.

1. $1\frac{6}{7}$.
2. $2\frac{5}{8}$.
3. $6\frac{1}{4}$.
4. $9\frac{8}{11}$.
5. $13\frac{5}{16}$.
6. 11.
7. $14\frac{24}{25}$.
8. 37.
9. $50\frac{73}{75}$.
10. $26\frac{82}{177}$.
11. $3\frac{570}{753}$.
12. 13.
13. $18\frac{7}{29}$.
14. $18\frac{30}{42}$.
15. 359.

Exercise XIX.

Page 123.

1. $\frac{31}{9}$.
2. $\frac{59}{10}$.
3. $\frac{136}{11}$.
4. $\frac{197}{19}$.
5. $\frac{59}{7}$.
6. $\frac{193}{15}$.
7. $\frac{1697}{20}$.
8. $\frac{83821}{97}$.
9. $\frac{41083}{1000}$.
10. $\frac{410003}{10000}$.
11. $\frac{160127}{400}$.
12. $\frac{25000083}{5000}$.
13. $\frac{150014}{15}$.
14. $\frac{2100783}{700}$.
15. $\frac{7299}{99}$.
16. $\frac{40}{5}$, $\frac{35}{5}$, $\frac{15}{5}$, $\frac{25}{5}$, $\frac{60}{5}$, $\frac{65}{5}$, $\frac{90}{5}$, $\frac{100}{5}$, $\frac{125}{5}$.
17. $\frac{63}{3}$, $\frac{105}{5}$, $\frac{147}{7}$, $\frac{168}{8}$, $\frac{252}{12}$, $\frac{273}{13}$, $\frac{420}{20}$, $\frac{525}{25}$, $\frac{630}{30}$, $\frac{777}{37}$.
18. $\frac{144}{12}$, $\frac{180}{15}$, $\frac{276}{23}$, $\frac{180}{12}$, $\frac{225}{15}$, $\frac{345}{23}$, $\frac{276}{12}$, $\frac{345}{15}$, $\frac{529}{23}$.

Exercise XX.

Page 124.

1. $\frac{5}{8}$.
2. $\frac{7}{9}$.
3. $\frac{116}{165}$.
4. $\frac{12}{17}$.
5. $\frac{16}{81}$.
6. $\frac{3}{4}$.
7. $\frac{11}{14}$.
8. $\frac{5}{16}$.
9. $\frac{8}{13}$.
10. $\frac{11}{13}$.
11. $\frac{8}{9}$.
12. $\frac{27}{91}$.
13. $\frac{17}{23}$.
14. $\frac{1}{4}$.
15. $\frac{144}{175}$.
16. $\frac{7}{80}$.
17. $\frac{8}{15}$.
18. $\frac{35}{54}$.
19. $\frac{12}{49}$.
20. $\frac{32}{767}$.
21. $\frac{97}{117}$.
22. $\frac{212}{315}$.
23. $\frac{349}{481}$.
24. $\frac{3}{11}$.
25. $\frac{11}{25}$.
26. $\frac{35}{47}$.
27. $\frac{79}{91}$.
28. $\frac{293832}{34921}$.
29. $\frac{65}{999}$.
30. $\frac{3}{7}$.

Exercise XXI.

Page 125.

1. $1\frac{1}{2}$. 2. $6\frac{3}{4}$. 3. 4. 4. 15. 5. 3. 6. 10. 7. $1\frac{1}{4}$. 8. $\frac{2}{3}$. 9. 15. 10. $1\frac{3}{10}$. 11. $1\frac{19}{20}$. 12. $2\frac{3}{5}$. 13. $3\frac{1}{4}$. 14. $3\frac{9}{10}$. 15. $4\frac{11}{20}$. 16. $5\frac{1}{5}$. 17. $6\frac{1}{2}$. 18. $7\frac{4}{5}$. 19. $9\frac{3}{4}$. 20. 13.

Exercise XXII.

Page 126.

1. $\frac{14}{33}$. 2. $\frac{9}{10}$. 3. $\frac{5}{21}$. 4. 6. 5. $10\frac{2}{7}$. 6. $45\frac{1}{9}$. 7. 2. 8. $\frac{1}{3}$. 9. $1\frac{1}{5}$. 10. $3\frac{3}{4}$. 11. $1\frac{7}{20}$. 12. $48\frac{3}{10}$. 13. $1\frac{1}{3}$. 14. $\frac{5}{6}$. 15. $1\frac{173}{627}$. 16. $\frac{117}{946}$. 17. $8\frac{2}{11}$. 18. $1\frac{1}{3}$. 19. 1.

Page 127.

20. $6\frac{6}{55}$. 21. $\frac{51}{710}$. 22. $\frac{3}{4}$. 23. $\frac{1}{15}$. 24. 8. 25. $\frac{3}{4}$. 26. $2\frac{13}{16}$. 27. $52\frac{4}{27}$. 28. $20\frac{5}{11}$. 29. $32\frac{1}{12}$. 30. $\frac{28}{45}$. 31. $\frac{9}{76}$. 32. $\frac{32}{405}$. 33. $\frac{50}{243}$.

Exercise XXIII.

1. $\frac{4}{35}$. 2. $\frac{2}{11}$. 3. $\frac{3}{56}$. 4. $2\frac{2}{3}$. 5. $\frac{5}{6}$. 6. 2. 7. $\frac{21}{40}$. 8. $1\frac{4}{35}$. 9. 2. 10. $1\frac{17}{25}$. 11. $\frac{27}{38}$. 12. $1\frac{6}{7}$. 13. $7\frac{1}{2}$. 14. $\frac{9}{14}$. 15. $1\frac{1}{6}$. 16. 3. 17. $\frac{9}{14}$. 18. 2. 19. $6\frac{2}{7}$.

Exercise XXIV.

Page 129.

1. $\frac{15\ 12\ 25}{30}$. 2. $\frac{240\ 200\ 315\ 324}{360}$. 3. $\frac{700\ 105\ 200\ 456}{840}$. 4. $\frac{120\ 315\ 108\ 160}{900}$. 5. $\frac{288\ 255\ 130\ 152}{600}$. 6. $\frac{315\ 196\ 96\ 90\ 665}{840}$. 7. $\frac{1485\ 840\ 1404\ 1656\ 680}{2160}$.

8. $\frac{17}{25}$, $\frac{5}{6}$, $\frac{3}{5}$. 9. $\frac{13}{24}$, $\frac{7}{12}$, $\frac{11}{18}$. 10. $\frac{4}{11}$, $\frac{7}{18}$, $\frac{5}{12}$, $\frac{8}{15}$.

Exercise XXV.

Page 131.

1. 2.
2. $1\frac{1}{3}$.
3. $1\frac{1}{4}$.
4. 4.
5. 4.
6. 4.
7. $6\frac{2}{5}$.
8. $2\frac{1}{4}$.
9. $2\frac{3}{17}$.
10. $21\frac{3}{17}$.
11. $1\frac{19}{30}$.
12. $1\frac{5}{8}$.
13. $\frac{2}{3}$.
14. $\frac{49}{60}$.
15. $\frac{37}{48}$.
16. $19\frac{13}{16}$.
17. $113\frac{7}{36}$.
18. $1\frac{17}{60}$.
19. $2\frac{43}{60}$.
20. $3\frac{1}{15}$.
21. $85\frac{83}{600}$.
22. $199\frac{47}{68}$.
23. $12\frac{1}{16}$.
24. $8\frac{73}{100}$.
25. $11\frac{263}{504}$.
26. $11\frac{461}{504}$.
27. $10\frac{733}{840}$.
28. $1\frac{179}{200}$.
29. $14\frac{61}{72}$.
30. $18\frac{9}{176}$.
31. $8\frac{13}{18}$.
32. $10\frac{31}{77}$.
33. $341\frac{107}{120}$.
34. $\frac{173}{228}$.
35. $1\frac{35}{204}$.
36. $346\frac{401}{510}$.
37. $29\frac{36}{385}$.
38. $18\frac{1241}{2880}$.
39. $294\frac{1069}{1092}$.
40. $465\frac{411}{616}$.

Exercise XXVI.

Page 133.

1. $6\frac{1}{8}$.
2. $\frac{1}{3}$.
3. $\frac{1}{12}$.
4. $\frac{7}{60}$.
5. $\frac{25}{63}$.
6. $3\frac{1}{2}$.
7. $6\frac{1}{3}$.
8. $2\frac{1}{6}$.
9. $7\frac{4}{7}$.
10. $4\frac{1}{5}$.
11. $4\frac{2}{9}$.
12. $1\frac{1}{6}$.
13. $\frac{34}{35}$.
14. $5\frac{1}{30}$.
15. $2\frac{23}{45}$.
16. $3\frac{11}{12}$.
17. $4\frac{29}{30}$.
18. $4\frac{1}{6}$.
19. $2\frac{1}{12}$.
20. $4\frac{3}{4}$.
21. $3\frac{22}{35}$.
22. $57\frac{70}{99}$.
23. $6\frac{1}{80}$.
24. $6\frac{3}{8}$.
25. $10\frac{11}{96}$.
26. $4\frac{117}{140}$.
27. $10\frac{323}{440}$.
28. $\frac{749}{960}$.
29. $2\frac{1683}{4000}$.
30. $1193\frac{1}{12}$.
31. $1193\frac{73}{156}$.
32. $1193\frac{17}{36}$.
33. $248\frac{25}{48}$.
34. $114\frac{47}{66}$.
35. $101\frac{37}{154}$.
36. $2\frac{81}{154}$.
37. $4\frac{19}{42}$.
38. $\frac{48}{119}$.
39. $\frac{1}{756}$.
40. $\frac{13}{418}$.
41. $\frac{218}{1911}$.
42. $\frac{1}{450}$.

Exercise XXVII.

Page 134.

1. $1\frac{23}{72}$.
2. $3\frac{157}{176}$.
3. $1\frac{2}{7}$.
4. $27\frac{29}{80}$.
5. 0.
6. $25\frac{17}{216}$.
7. $344\frac{19}{39}$.
8. $186\frac{28}{117}$.
9. $\frac{15}{52}$.
10. $6\frac{463}{495}$.
11. $\frac{441}{2000}$.
12. $1\frac{1}{24}$.
13. $8\frac{7}{180}$.
14. $1\frac{1}{15}$.
15. $\frac{151}{180}$.
16. $4\frac{73}{360}$.
17. $137\frac{179}{252}$.
18. $11\frac{59}{120}$.
19. $5\frac{61}{120}$.
20. $25\frac{71}{900}$.
21. $1\frac{647}{1120}$.
22. $3\frac{7457}{100000}$.

Exercise XXVIII.

Page 136.

1. $\frac{20}{33}$.
2. $\frac{8}{19}$.
3. $1\frac{2}{7}$.
4. $\frac{1}{15}$.
5. $\frac{11}{18}$.
6. $1\frac{11}{21}$.
7. $4\frac{8}{15}$.
8. $2\frac{82}{567}$.
9. $1\frac{2}{7}$.
10. $1\frac{1}{2}$.
11. $10\frac{1}{35}$.
12. $\frac{1}{24}$.
13. $\frac{3}{7}$.
14. $\frac{2}{5}$.
15. $3\frac{1}{2}$.
16. $2\frac{29}{80}$.
17. 185.
18. $\frac{53}{122}$.
19. $\frac{8}{9}$.
20. 20.
21. $\frac{9}{35}$
22. 1.

Exercise XXIX.

Page 137.

1. $\frac{3}{8}$.
2. $2\frac{2}{3}$.
3. $\frac{7}{9}$.
4. $1\frac{2}{7}$.
5. $1\frac{1}{2}$.
6. $\frac{2}{3}$.
7. $\frac{3}{11}$.
8. $3\frac{2}{3}$.
9. $\frac{5}{11}$.
10. $2\frac{1}{5}$.
11. $3\frac{3}{56}$.
12. $\frac{51}{176}$.
13. $2\frac{31}{70}$.
14. $\frac{3}{4}$.
15. 2.
16. $\frac{1}{3}$.
17. $\frac{3}{10}$.
18. $\frac{4}{33}$.
19. $\frac{1}{5}$.
20. $\frac{7}{8}$.
21. $\frac{1}{15}$.
22. $\frac{3}{50}$.
23. $\frac{9}{200}$.
24. $6\frac{1}{4}$.
25. $\frac{76}{905}$.
26. $\frac{1}{7}$.
27. $1\frac{1}{7}$.
28. $\frac{4}{15}$.
29. $110\frac{275}{578}$.
30. $\frac{9}{10}$.
31. 1.
32. 1.
33. $\frac{1}{185}$.
34. $2\frac{16}{53}$.
35. $\frac{32627}{32825}$.
36. $1\frac{142}{7047}$.
37. $\frac{7}{9}$.
38. $\frac{102}{113}$.

Exercise XXX.

Page 138.

1. $\frac{1}{8}$.
2. $\frac{5}{8}$.
3. $\frac{27}{40}$
4. $10\frac{108}{125}$.
5. $50\frac{21}{25}$.
6. $3\frac{1}{4000}$.
7. $8\frac{43}{400}$.
8. $35\frac{32}{3125}$.
9. $7\frac{1}{64}$.
10. $20\frac{3133}{31250}$.
11. $10\frac{503}{40000}$.
12. $104\frac{47}{200}$.
13. $50\frac{1}{2500}$.
14. $100\frac{1}{1000}$.
15. $8\frac{29}{4000}$.
16. $20\frac{147}{8000}$.
17. $125\frac{378}{625}$.
18. $\frac{16}{125}$.
19. $\frac{117}{160}$.
20. $1\frac{3}{16}$.
21. $\frac{193}{320}$.
22. $6\frac{1}{32}$.
23. $60\frac{5}{16}$.
24. $7\frac{63}{2000}$.

Exercise XXXI.

1. 0.875.
2. 0.9375.
3. 0.28125.
4. 0.36.
5. 0.078125.
6. 4.01375.
7. 5.00015625.
8. 9.0048046875.
9. 11.00475.
10. 0.072.
11. 0.00425.
12. 0.9296875.
13. 0.0208.
14. 0.04296875.
15. 0.01875.
16. 7.75.
17. 1.2.
18. 0.328125.
19. 14.8.
20. 0.69384765625.

Exercise XXXII.

Page 139.

1. 33.58125; $33\frac{93}{160}$.
2. 104.9938091; $104\frac{2087}{2100}$.
3. 65.324375; $65\frac{519}{1600}$.
4. 46.2625; $46\frac{21}{80}$.
5. 9.16875; $9\frac{27}{160}$.
6. 3.71875; $3\frac{23}{32}$.
7. 6.2625; $6\frac{21}{80}$.
8. 2.775; $2\frac{31}{40}$.
9. 44.5125; $44\frac{41}{80}$.
10. 82.8192; $82\frac{512}{625}$.
11. 3.1875; $3\frac{3}{16}$.
12. 0.388125; $\frac{621}{1600}$.
13. 7.91875; $7\frac{147}{160}$.
14. 296.875; $296\frac{7}{8}$.

Exercise XXXIII.

Page 141.

1. $0.\dot{5}$.
2. $0.\dot{4}\dot{5}$.
3. $3.41\dot{6}$.
4. $0.18\dot{3}$.
5. $3.3541\dot{6}$.
6. $2.\dot{1}3\dot{5}$.
7. $0.00\dot{0}8\dot{1}$.
8. $11.13\dot{0}9523\dot{8}$.
9. $9.10\dot{1}8\dot{5}$.
10. $11.1\dot{1}4285\dot{7}$.
11. $0.267857142\dot{8}$.
12. $0.\dot{3}8095\dot{2}$.
13. $0.\dot{3}\dot{9}$.
14. $0.5\dot{2}8571\dot{4}$.
15. $2.2\dot{2}74509803921568\dot{6}$.
16. $5.\dot{2}3076\dot{9}$.
17. Seven.

Page 142.

18. Five.
19. Two.

Exercise XXXIV.

Page 143.

1. $\frac{27}{110}$.
2. $\frac{421}{990}$.
3. $53\frac{9}{3700}$.
4. $7\frac{2009}{9990}$.
5. $2\frac{1751}{3300}$.
6. $\frac{211}{49500}$.
7. $31\frac{67}{330}$.
8. $\frac{13}{37}$.
9. $1\frac{5}{12}$.
10. $\frac{557}{999}$.
11. $2\frac{9}{110}$.
12. $5\frac{91}{740}$.
13. $\frac{79}{220}$.
14. $4\frac{117}{370}$.
15. $\frac{3638}{4995}$.
16. $5\frac{71428}{499995}$.
17. $\frac{1183}{4995}$.
18. $1\frac{3}{22}$.
19. $1\frac{59}{111}$.
20. $3\frac{643}{2220}$.
21. $5\frac{527}{600}$.
22. $1\frac{11567}{16665}$.
23. $\frac{447}{925}$.
24. $\frac{1357}{1111100}$.

Exercise XXXV.

Page 144.

1. $\frac{1}{135}$	G.C.M.;	14	L.C.M.	7. $5\frac{11}{18}$	G.C.M.;	14,140	L.C.M.
2. $\frac{1}{90}$	"	60	"	8. $\frac{1}{2520}$	"	2520	"
3. $\frac{9}{56}$	"	10,530	"	9. $\frac{5}{42}$	"	$85\frac{5}{7}$	"
4. $\frac{7}{360}$	"	$20\frac{5}{12}$	"	10. $2\frac{3}{10}$	"	460	"
5. $\frac{11}{36}$	"	4620	"	11. $6\frac{5}{12}$	"	8085	"
6. $\frac{1}{60}$	"	1	"	12. $\frac{1}{300}$	"	$40\frac{8}{25}$	"

Page 145.

13. 2737. 14. 77. 15. $1\frac{5}{18}$.

Exercise XXXVI.

1. $\frac{7}{18}$; $\frac{973}{1263}$; $\frac{203}{47268}$; $\frac{67}{83}$. 3. $20\frac{1}{10}$. 5. $3\frac{11}{15}$.
2. $\frac{19}{24}$; by $\frac{1}{72}$. 4. $3\frac{13}{35}$. 6. $4\frac{4}{21}$.
7. $2\frac{6}{11}$; $5\frac{1}{11}$; $11\frac{11}{190}$; $22\frac{1}{2}$; 3; $\frac{9}{11}$; $1\frac{71}{448}$; $\frac{4}{11}$; $1\frac{1}{5}$; $\frac{9}{14}$; 12; $3\frac{64}{75}$.
8. $60\frac{3}{4}$; $286\frac{1}{2}$; $\frac{5}{6}$; 258; $\frac{121}{156}$; $\frac{1}{15}$; $\frac{4}{11}$; $\frac{1}{11}$.
9. 3; 4; $1\frac{2}{3}$; $1\frac{1}{4}$; $1\frac{11}{24}$.

Page 146.

10. $\frac{1}{3}$; 4; 1; $1\frac{3}{32}$; $\frac{24}{35}$; $1\frac{13}{243}$. 12. $8\frac{7}{45}$. 13. $\frac{13}{30}$.
11. $10\frac{7}{72}$. 14. $\frac{29}{228}$.
15. 0.5; 0.75; 0.625; 0.1875; 0.5625; 0.9375; $0.\dot{4}2857\dot{1}$; 0.25; 0.125; 0.875; 0.3125; 0.6875; $0.1\dot{6}$; $0.\dot{5}$; $0.\dot{2}\dot{7}$; $0.\dot{3}$; 0.375; 0.0625; 0.4375; 0.8125; $0.8\dot{3}$; 0.175.
16. $\frac{4}{25}$; $\frac{13}{100}$; $\frac{1}{160}$; $\frac{2}{25}$; $\frac{2716}{4995}$; $\frac{34213}{49950}$; $\frac{2}{125}$; $\frac{29}{40}$; $\frac{13}{16}$; $\frac{6}{11}$; $\frac{3}{110}$; $1\frac{19}{55}$. $\frac{1}{8}$; $\frac{5}{8}$; $\frac{1}{32}$; $\frac{1}{60}$; $\frac{5}{18}$;
17. $5\frac{3}{5}$ or 5.6. 19. 6.7. 21. $121\frac{1}{3}$ or $\frac{364}{3}$.
18. $36\frac{213}{242}$. 20. $40\frac{1}{4}$. 22. 47.917.
23. $0.8\dot{6}$; $0.\dot{2}\dot{7}$; $0.28\dot{3}$; $0.\dot{3}8461\dot{5}$; $0.1\dot{1}42857\dot{1}$; $0.\dot{7}36842105263157894\dot{1}$; $0.\dot{1}320754716981\dot{1}$.
24. $\frac{1}{85}$. 26. 0.09375; 0.00009375; $0.2\dot{0}9\dot{7}$; $0.\dot{1}42857\dot{1}$.
25. $\frac{1}{8}$. 27. $\frac{1}{2}$.

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28. $\frac{11}{78}$. **29.** $3\frac{131}{216}$. **34.** $7\frac{2009}{9990}$; $6\frac{21}{22}$; $5\frac{10}{33}$; $21\frac{44}{111}$.
30. G. C. M. 49; L. C. M. 3889277. **35.** $\frac{7}{8}$. **39.** $4\frac{23}{64}$.
36. $10\frac{55}{112}$. **40.** $12\frac{122}{175}$.
31. $\frac{17}{20}$, $\frac{9}{11}$, $\frac{32}{45}$, $\frac{19}{27}$, $\frac{20}{33}$. **37.** $\frac{2}{3}$. **41.** $5\frac{1}{16}$. **43.** $\frac{16}{125}$.
32. $22\frac{16}{17}$. **33.** $\frac{13}{1088}$. **38.** 6.33403. **42.** $\frac{3}{4}$. **44.** $\frac{4}{9}$.
45. $0.\dot{7}31343283582089552238805970149253\dot{3}$; $0.\dot{3}7\dot{8}$; $0.\dot{8}4931506\dot{}$. **46.** 30, 45, 75 (the smallest).

Exercise XXXVII.

Page 151.

1. 132 in. **2.** 23,166 ft. **3.** 5499 in. **4.** 5,294,820 ft
5. 1309 mi. 192 rds. 4 yds. 2 ft. 8 in. **6.** 443,646 in.
7. 1,754,676 in. **8.** 45,112,320 in.

9. 102 mi. 114 rds. 3 yds. 1 ft.
10. 4 mi. 89 rds. 5 yds. 1 ft. 2 in.
11. 137 mi. 36 rds. 3 yds. 1 ft.
12. 3 mi. 217 rds. 4 yds. 1 ft. 3 in.
13. 7920 in. **14.** 3238 fath. 4 ft. 1 in.
15. 5 ft. 4 in. **16.** $27\frac{3}{11}$ mi.

Exercise XXXVIII.

Page 152.

1. 120,058,848 sq. in. **4.** 1148 sq. rds. 2 sq. yds.
2. 944 sq. yds. 103 sq. in. **5.** 23,048,771 sq. in.
3. 73,830,400 sq. rds. **6.** 43,560 sq. ft.

7. 15 A. 148 sq. rds. 2 sq. yds. 2 sq. ft. 40 sq. in.
8. 3 A. 28 sq. rds. 9 sq. yds.
9. 14 sq. rds. 10 sq. yds. 7 sq. ft. 110 sq. in.

Exercise XXXIX.

Page 153.

1. 202 cu. ft.
2. 1,175,183 cu. in.
3. 43 cu. ft. 21 cu. in.
4. 9 cu. yds. 11 cu. ft. 88 cu. in.
5. 19 cu. yds. 20 cu. ft. 706 cu. in.
6. $9\frac{1}{7}$ ft.
7. $101.86.

Exercise XL.

Page 154.

1. 59 pts.
2. 66 bu. 5 qts.
3. 790 gi.
4. 233 qts. $1\frac{1}{2}$ pts.
5. 465 qts. 0 pts. $3\frac{7}{11}$ gi.
6. 1.244 cu. ft.
7. 0.8036 bu.
8. 109,792 pts.
9. 96 bbls. 23 gals.

Exercise XLI.

Page 155.

1. 4 lbs. 9 oz. 9 dwts. 11 grs.
2. 15 l. t. 9 l. cwt. 44 lbs.
3. 4 t. 5 cwt. 53 lbs. 3 oz.
4. 150 lbs. 8 dwts. 13 grs.
5. 123 lbs. 7 oz. 5.2 drs.
6. 32,316 grs.
7. 905 lbs. 4 oz. 11 dwt. 16 grs.
8. 613 lbs. $7\frac{11}{35}$ drs.
9. 45 t. 27 lbs. 13 oz. 5 drs.
10. 176 t. 5 cwt. 48 lbs. 5 oz. 13 drs.
11. 7680 ♏.
12. 16 fl. oz. 5 fl. drms. 20 ♏.

Exercise XLII.

Page 156.

1. 22,645 sec.
2. 544,324 min.
3. 33 dys. 17 hrs. 27 min.
4. 8 dys. 14 hrs. 13 min. 12 sec.
5. 151; 118; 286; 151 dys.
6. 151,200 min.
7. 468,000 sec.
8. 1600, 1656, 1880, 1924, 2000.

Exercise XLIII.

Page 157.

1. 9025″. 2. 54,202″. 3. 15° 46′. 4. 58° 57′ 1″.
5. 90°, 120°, (180°), 45°, 30°, 0°.
6. 2815 geog. mi.; 3244.75$\frac{2}{3}$ stat. mi.

Exercise XLIV.

Page 158.

1. 140,000 *d.*
2. 76,750 far.
3. £119 1 *s.*
4. 2268 half sov. 2 *s.* 7 *d.*
5. 6495 *g.* 10 *s.*
6. £1,801,919 14 *s.*
7. £303 10 *s.* 3 *d.* 2 far.
8. 2813 *g.* 20 *s.* 10 *d.*
9. 1193 crowns 6 *d.* 3 far.
10. $3.86.
11. $4.76.
12. $3.67.
13. £61 2 *s.* 6 *d.*

Exercise XLV.

Page 160.

1. 15° C.; 12° R.
2. 25° C.; 20° R.
3. 510° C.; 408° R.
4. −40° C.; −32° R.
5. −20° C.; −16° R.
6. 50° F.; 8° R.
7. 71$\frac{3}{5}$° F.; 17$\frac{3}{5}$° R.
8. −22° F.; −24° R.
9. 11$\frac{3}{7}$° F.; −9$\frac{1}{7}$ R.
10. 41° F.; 5° C.
11. 59° F.; 15° C.
12. −13° F.; −25° C.
13. 39$\frac{1}{5}$° F.; 3$\frac{1}{5}$° R.
14. −17$\frac{7}{9}$° C.; −14$\frac{2}{9}$° R.

Exercise XLVI.

Page 162.

1. 3 dys. 4 hrs. 34 min. 36 sec.
2. 245 cu. yds. 4 cu. ft. 1514 cu. in.
3. £92 12 *s.* 1 *d.* 3 far.
4. 35 mi. 126 rds. 4 yds. 1 in.
5. 151 A. 55 sq. rds. 29 sq. yds. 7 sq. ft. 34 sq. in.
6. 23 bu. 6 qts. 1 pt.
7. 212 t. 6 cwt. 3 oz. 10 drs.
8. 243 gals. 1 qt. 1 gi.
9. 84 lbs. 2 oz. 14 dwt.
10. 41 gals. 1 pt.
11. 132° 30′ 45″.

Exercise XLVII.

Page 163.

1. 34 lbs. 9 oz. 18 dwt. 11 grs.
2. 1 pk. 4 qts. 1 pt.
3. 7 cu. yds. 3 cu. ft. 1528 cu. in.
4. £27 18 *s.* $2\frac{3}{4}$ *d.*
5. 7 gals. 2 qts. 1 pt.
6. 8 t. 5 cwt. 98 lbs. 5 oz. 11 drs.
7. 6 A. 9 sq. rds. 174 sq. ft. 26 sq. in.
8. 31° 37′ 45″.
9. 298 dys. 21 hrs.
10. 202 rds. 4 yds. 3 in.

Exercise XLVIII.

Page 164.

1. £249 4 *d.*
2. 1391 gals. 1 qt.
3. 33 lbs. 8 oz. 4 dwt. 4 grs.
4. 55 t. 6 cwt. 70 lbs.
5. 2740 bu. 2 pks.

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6. 108 wks. 1 dy. 12 hrs. 24 min.
7. 32 cu. yds. 7 cu. ft. 498 cu. in.
8. 3 sq. mi. 553 A. 27 sq. rds. 3 sq. yds. 2 sq. ft. 36 in.
9. 5 mi. 258 rds. 3 yds.
10. 10 yrs. 67 dys. 23 hrs. 45 min. 36 sec.
11. 38,508 mi. 19 rds. 3 yds.
12. 2147 lbs. 9 ℥ 4 ʒ 1 ℈ 7 grs.

Exercise XLIX.

Page 166.

1. 1 mi. 207 rds. 2 yds. 8 in.
2. 137.
3. 8 wks. 1 dy. 7 hrs. 50 min. $2\frac{121}{343}$ sec.
4. 77.
5. 325.
6. 7 sq. mi. 264 A. 39 sq. rds.
7. 7.

Exercise L.

Page 167.

1. 256 rds.
2. 30 sq. rds.
3. 62 lbs. 8 oz.
4. 13 *s.* 4 *d.*
5. 261 rds. 4 yds. 1 ft. 6 in.
6. 101 sq. rds. 24 sq. yds. 6 sq. ft. 108 sq. in.
7. 26′ 40″.
8. 121 dys. 16 hrs.
9. 5 qts.
10. 2 qts. 1 pt.
11. 320 dys. 6 hrs.
12. 3 oz. 18 dwt.

Exercise LI.

Page 168.

1. 23 A. 40 sq. rds. 16 sq. yds. 1 sq. ft. $28\frac{4}{5}$ sq. in.
2. 10 hrs. 30 min. $38\frac{4}{7}$ sec.
3. 15 dys. 10 hrs. 38 min. 51 sec.
4. 34 rds. 2 yds. $4\frac{4}{15}$ in.
5. 57 rds. 2 yds. 2 ft. 7.5936 in.
6. 5 t. 6 cwt. 94 lbs.
7. 8 oz. 6 dwt. $2\frac{2}{3}$ grs.
8. 1 lb. 6 oz. 13 dwt. 8 grs.
9. 3 mi. 198 rds. 4 yds. $4\frac{1}{2}$ in.
10. 2 wks. 2 dys. 3 hrs. 35 min.
11. 12 dys. 10 hrs. 31 min. 30 sec.
12. 86 rds. 4 yds. $1\frac{1}{2}$ in.
13. 4 cwt. 72 lbs. 4 oz. $9\frac{1}{7}$ drs.

Exercise LII.

Page 169.

1. $\frac{175}{144}$.
2. $\frac{175}{192}$.
3. $\frac{3}{40}$ A.
4. $\frac{2}{3}$.
5. $\frac{40}{63}$.
6. $\frac{1}{70}$.
7. $\frac{5}{48}$.
8. $\frac{7}{135}$.
9. $\frac{28}{45}$.
10. $\frac{1}{6}$.
11. $\frac{1}{20}$.
12. $\frac{3}{11}$.
13. $\frac{59}{8640}$.
14. $\frac{21}{64}$.
15. $\frac{387}{400}$.
16. $\frac{78}{125}$.
17. $\frac{42161}{174240}$.

Exercise LIII.

Page 170.

1. £0.815625. **3.** 0.445 A. **5.** 0.242. **7.** 0.0311.
2. 0.73 mi. **4.** 0.3174. **6.** 0.501. **8.** 0.303.

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9. $0.\dot{1}4\dot{8}$. **10.** 0.243.
11. 5.128 (reckoning 365 days).
12. 1.139. **13.** 0.15433. **14.** 0.03. **15.** 0.4388.

Exercise LIV.

Page 172.

1. 18° 45′. **4.** 51° 23′ 45″. **7.** 272° 30′.
2. 32° 45′. **5.** 93° 7′ 30″. **8.** 228° 48′ 45″.
3. 77° 32′ 30″. **6.** 62° 3′. **9.** 37 min. 20 sec.

10. 4 hrs. 42 min.
11. 3 hrs. 46 min. $24\frac{4}{5}$ sec.
12. 7 hrs. 14 min. $10\frac{2}{5}$ sec.
13. 8 hrs. 58 sec.
14. 6 hrs. 43 min. 3.6 sec.
15. 8 min. $8\frac{2}{15}$ sec.
16. 5 hrs. 40 sec.

Exercise LV.

Page 174.

1. (1) 12 h. 53 m. $34\frac{13}{15}$ s. P.M.
(2) 12 h. 49 m. $48\frac{14}{15}$ s. P.M.
(3) 1 h. 55 m. 56 s. P.M.
(4) 7 h. 45 m. 35 s. P.M.
(5) 3 h. 50 m. 15 s. A.M.
(6) 5 h. 58 m. 59 s. A.M.
(7) 2 h. 22 m. 8 s. P.M.
(8) 4 h. 51 m. 36 s. P.M.
(9) 5 h. 53 m. $16\frac{2}{15}$ s. P.M.
(10) 6 h. 9 m. 40 s. A.M.
(11) 7 h. 3 m. $59\frac{4}{5}$ s. A.M.
(12) 7 h. 6 m. 20 s. A.M.

2. (1) 11 h. 13 m. $54\frac{13}{15}$ s. P.M.
(2) 11 h. 10 m. $8\frac{14}{15}$ s. P.M.
(3) 12 h. 16 m. 16 s. A.M.
(4) 6 h. 5 m. 55 s. A.M.
(5) 2 h. 10 m. 35 s. P.M.
(6) 4 h. 19 m. 19 s. P.M.
(7) 12 h. 42 m. 28 s. A.M.
(8) 3 h. 11 m. 56 s. A.M.
(9) 4 h. 13 m. $36\frac{2}{15}$ s. A.M.
(10) (4 h. 30 m.)
(11) 5 h. 24 m. $19\frac{4}{5}$ s. P.M.
(12) 5 h. 26 m. 40 s. P.M.

3. (1) 6 h. 57 m. $38\frac{13}{15}$ s. A.M.
(2) 6 h. 53 m. $52\frac{14}{15}$ s. A.M.
(3) (8 A.M.)
(4) 1 h. 49 m. 39 s. P.M.
(5) 9 h. 54 m. 19 s. P.M.
(6) 12 h. 3 m. 3 s. A.M.
(7) 8 h. 26 m. 12 s. A.M.
(8) 10 h. 55 m. 40 s. A.M.
(9) 11 h. 57 m. $20\frac{2}{15}$ s. A.M.
(10) 12 h. 13 m. 44 s. A.M.
(11) 1 h. 8 m. $3\frac{4}{5}$ s. A.M.
(12) 1 h. 10 m. 24 s. A.M.

Exercise LVI.

Page 174.

1. (1) 71° 3′ 30″ W.
(2) 69° 50′ W.
(3) 81° 7′ W.
(4) 92° 12′ W.
(5) 112° 30′ W.
(6) 73° 44′ 45″ W.
(7) 83° 3′ W.
(8) 76° 50′ W.
(9) 90° W.
(10) 89° 33′ W.
(11) 77° 4′ W.

Exercise LVII.

Page 175.

1. 7.875 gals. **2.** £4 7 *s.* 6 *d.* **3.** 7 gals. 2 qts. 1.5 pts.
4. £1 4 *s.* $2\frac{70}{97}$ *d.*; £1 10 *s.* $5\frac{19}{97}$ *d.*;
£3 13 *s.* $7\frac{29}{97}$ *d.*; £4 9 *s.* $8\frac{28}{97}$ *d.*

5. 17,983.504 sq. yds.
6. $\frac{1}{9}$ turpentine; $\frac{1}{9}$ pt.
7. 9104 yds. 2 ft. 5.952 in.
8. $4\frac{188}{195}$ ft.
9. 4.32 oz.; 1890 troy grs.
10. $\frac{1}{8}$.
11. $0.1051\dot{1}3\dot{6}$ mi.
12. 66,036 in.
13. 4320 cu. in.
14. $1687\frac{1}{2}$ lbs.
15. 0.84375 t.
16. $472\frac{1}{2}$ lbs.
17. 19 bu. 2 pks. 5.6 qts.

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18. $312\frac{1}{2}$ bu. **19.** 144 bottles. **20.** 156 mi. 72 rds.; $8\frac{1416}{2083}$ hrs.
21. 24 hrs., nearly.
22. $209.83.
23. $46.94.
24. $120.59.
25. $350.
26. 0.0184 mi.
27. 0.9703125 A.
28. 3 qts.
29. 94.5 mi.
30. $13\frac{8}{9}$ gross.
31. $2554.50.
32. The former, by 2 ft. 8.08 in.
33. 0.07056 t.
34. 0.03 sq. ch.
35. 0.192.
36. 0.09375.
37. 11 hrs. 6 min. 40 sec.

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38. A. **39.** $3\frac{15}{19}$ mi. **40.** $291.67.

41. 58 min. 14.91 sec.
42. 3 hrs. 12 min. 24 sec.
43. 2 ft. 11.6125 in.
44. 4 t. 1 cwt. $80\frac{7}{15}$ lbs.
45. 35.
46. The former; $\frac{39}{40}$.
47. 4436 mi. 99 rds. 1 yd. 6 in.
48. $15,832.30.
49. $8938\frac{142}{373}$.
50. 88 yds. $= \frac{1}{20}$ mi.; 3 min. $= \frac{1}{20}$ hr.
51. 42 min. 4 sec.

Exercise LVIII.

Page 178.

1. $43\frac{1}{5}$ mi. **3.** 4655.637 mi. **4.** $1173\frac{1}{3}$ ft.
2. 10,800 mi. **5.** $4\frac{4}{23}$ mi.

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6. $4\frac{29}{64}$ mi.
7. $6\frac{9}{94}$ in.
8. $2\frac{4}{5}$ min.
9. $2\frac{1}{6}$ min.
10. $4\frac{52}{75}$ sec.
11. 1 min. $43\frac{83}{139}$ sec.
12. $\frac{7}{15}$ day; $\frac{3}{14}$ A.
13. 1 A. 120 sq. rds.
14. $156\frac{2}{3}$ gals.
15. $5035.20.
16. 12 hrs.

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17. $3922.20.
18. $1\frac{22}{149}$ pts.
19. $1040\frac{140}{359}$ mi.
20. 24 mi.; 1 hr. 44 min. 10 sec.
21. $1\frac{5}{7}$ dys.
22. $2\frac{19}{40}$ dys.

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23. 1 hr. 58 min. $7\frac{1}{2}$ sec.
24. $5\frac{23}{247}$ hrs.
25. $1\frac{7}{29}$ dys.
26. $2\frac{16}{19}$ dys.
27. $\frac{6}{13}$ hr.
28. $56\frac{1}{4}$ min.; 125 gals.
29. 1 hr. 42 min. $51\frac{3}{7}$ sec.
30. 1 hr. 3 min. $34\frac{62}{67}$ sec.
31. $2\frac{22}{159}$ all. $4\frac{24}{79}$, A; $5\frac{55}{57}$, B; $14\frac{18}{23}$, C.

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32. 992 bu.
33. 18 girls; 32 scholars.
34. 26 boys; 22 girls.
35. 35.
36. 120.
37. 35.
38. 18 dwt. 8 grs. troy; $1\frac{1}{175}$ oz. av.
39. A, $21,000; B, $15,000; C, $9000.
40. $1\frac{5}{18}$.
41. $13,200.
42. $\frac{16}{27}$, $\frac{15}{26}$, $\frac{13}{25}$.

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43. \$0.75. **46.** $19\frac{1079}{1900}$ lbs. **49.** 27 min. **52.** $1\frac{1}{2}$ dys.
44. \$2665. **47.** \$1.44. **50.** \$9.336. **53.** 324.
45. \$25.42. **48.** $\frac{14}{165}$. **51.** $61\frac{1}{3}$ A. **54.** 90.

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55. 300. **56.** 7 mos. **57.** $34\frac{394}{459}$. **58.** 16. **59.** 500.

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60. 20. **62.** 4 dys. **64.** 2 dys. **66.** $6\frac{3}{7}$ yds. **68.** $1396\frac{4}{11}$.
61. 11,268. **63.** 84. **65.** 15. **67.** $2\frac{2}{5}$ ft. **69.** $67\frac{2}{3}$.
70. C the fastest; A 41 sec., B $19\frac{1}{15}$ sec.

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71. \$89.40. **72.** \$7573.36. **73.** \$1830.70.

Exercise LIX.

Page 187.

1 9 ft. **3.** 13 A. 5.792 sq.ch. **5.** 418 yds. = 76 rds.
2. 60 rds. or 990 ft. **4.** 3 ft. **6.** 12 sq. ft.

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7. 5 sq. ft. 21 sq. in. **10.** 27,648. **13.** $344\frac{8}{9}$ sq. yds. border;
8. 36. **11.** 2 sq. ft. 81 sq. in. $411\frac{1}{9}$ sq. yds. path;
9. 15. **12.** \$15.20. 3500 sq. yds. grass.
14. 28.2744 sq. ft. **16.** 16,060.6446 sq. ft.
15. 502,656 sq. yds. **17.** 132.7326 sq. ft.

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18. 258.5248 sq. ft. **22.** $60\frac{2}{3}$ yds.; 63 yds.; none; $\frac{1}{3}$ yd.
19. 28.2744 sq. in. **23.** $59\frac{15}{16}$ yds. or 60 yds.
20. 452.3904 sq. in. **24.** $17\frac{1}{2}$ sq. yds.
21. 4 sq. ft. 52.32 sq. in. **25.** \$43.70.

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26. \$45.00 or \$46.67.
27. \$123.375.
28. \$194.79.
29. Lengthwise.
30. $81\frac{1}{2}$ sq. yds.
31. $199\frac{67}{324}$ sq. yds.
32. \$46.50
33. \$4.26.

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34. \$41.03. **35.** \$12.75. **36.** \$33.75. **37.** \$62.50

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38. $13\frac{1}{2}$; $14\frac{2}{3}$. **39.** $233\frac{1}{3}$. **40.** 78. **41.** 162. **42.** 207. **43.** 33. **44.** 140. **45.** 300. **46.** 325. **47.** \$2.36. **48.** \$14.85. **49.** \$9.94. **50.** \$1.80. **51.** \$3.92. **52.** \$32.84. **53.** \$10.71.

Page 193.

54. 187. **55.** 83. **56.** 302. **57.** 123. **58.** \$0.80. **59.** \$1.22. **60.** \$1.38. **61.** \$0.79.

Page 194.

62. 810. **63.** $3\frac{6}{25}$ in. **64.** $24\frac{1}{2}$ thousand.

Exercise LX.

Page 194.

1. 16 cu. ft. 72 cu. in.
2. 38,016 cu. ft.
3. 15 cu. yds. 16 cu. ft. 1512 cu. in.
4. $120\frac{3}{4}$ cu. yds.
5. $52\frac{8}{9}$ cu. ft.

Page 195.

6. 63 cu. in. **7.** 1512. **8.** \$855. **9.** $1\frac{5}{6}$ yds. **10.** 2 ft. 8 in. **11.** $13\frac{1}{3}$ ft. **12.** 259,200. **13.** $58\frac{1}{3}$ ft. **14.** 72 sq. ft. $48\frac{2}{3}$ sq. in. **15.** 36 sq. ft. 36 sq. in. **16.** 14,088.9375 or $14,088\frac{15}{16}$ t. **17.** 14,400.

Page 196.

18. \$194.79. **19.** $13\frac{1}{2}$ ft. **20.** $45\frac{5}{7}$ lbs. **21.** $6\frac{2}{3}$. **22.** 8 ft. **23.** \$13.67. **24.** $7\frac{11}{35}$ ft. **25.** $2\frac{2}{3}$ ft.

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26. $76\frac{4}{5}$ bu.
27. 156 bu.
28. $6\frac{1}{4}$ ft.
29. $16\frac{2}{3}$ ft.
30. 107.1 bu.
31. $1440.
32. $26\frac{1}{4}$.
33. $5\frac{32}{85}$ t.
34. $4278\frac{6}{7}$ gals.

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35. $132\frac{76}{77}$ gals.
36. $7\frac{37}{77}$ gals.
37. 840 cu. ft.
38. 1484.406 gals
39. 4.90875 gals.
40. 2.18 qts.
41. 696.9116 cu. in.
42. 15.708.
43. 0.267.
44. 28.51.
45. 0.859.

Page 199.

46. 1.728 cu. in.
47. $\frac{125}{216}$ oz.
48. $16\frac{2}{3}$ oz.
49. $\frac{24}{25}$ pts.
50. $253\frac{79}{432}$ grs.
51. 6.912.
52. 6.983.
53. $3\frac{651}{935}$ cu. in.
54. 2.987 cu. in.
55. $93\frac{3}{4}$.
56. 1 t. $31\frac{1}{4}$ lbs.; 1 t. 8 cwt. $43\frac{3}{4}$ lbs.
57. $3\frac{1073}{1925}$ in.
58. $1162\frac{1}{2}$.
59. 704,000.
60. $4\frac{1}{11}$ lbs; 1.44 sp. gravity.
61. $36\frac{1}{2}$ t.; 17,600.

Exercise LXI.

Page 202.

1. 90.816^{l}.
2. 3.73248^{kg}.
3. 38.6325^{cbm}.
4. 111.2945^{km}.
5. 4.890^{ha}.
6. 36.240^{st}.
7. 192.496^{kg}.
8. 8.98416^{hl}.

9. 9 mi. 100 rds. 4 yds., nearly.
10. 7 A. 66 sq. rds. 2 sq. yds., nearly.
11. 15 cu. yds. 23 cu. ft., nearly.
12. 107 qts. liquid, or 92 qts. dry, nearly.
13. 535 gals., or 57 bu., nearly.
14. 13 lbs. 4 oz. 15 dwts.
15. 6 cds. 80 cu. ft., nearly.
16. 74.75 sq. yds.
17. 1 t. 2 cwt. 7 lbs., nearly.

18. 1 A. 136 sq. rds. 16 sq. yds. **23.** 1312.
19. 1.275^{cbm}. **21.** 2.795 mi. **24.** $1.47.
20. 0.981 cu. yds. **22.** 444.5625 lbs. **25.** $8.40.
26. 206.029 lbs. or 93.437^{kg}.
27. Water: 226.233 lbs., 102.6^{kg}; oil: 201.7575 lbs., 91.5^{kg}.

Page 203.

28. 349 lbs., 158.277^{kg}. **32.** 45.721.
29. 297.1738 lbs., 134.9169^{kg}. **33.** 1 hr. 11 min., nearly.
30. 10.0277^{kg}, 22.111 lbs. **34.** 17 t. 16 cwt. 64 lbs.
31. $20.87. **35.** 13,616.64^{g}.
36. 15.786. **37.** $3.92. **38.** 13,777.796^{t}.

Exercise LXII.

Page 205.

1. 6 : 9. **2.** 9 : 12. **3.** 8 : 9. **4.** 8 : 14. **5.** $7 : $9.
6. 8 ft. : 11 ft. **7.** 5 : 3. **8.** $\frac{5}{8}$ yd. : $\frac{3}{8}$ yd.

Exercise LXIII.

Page 208.

1. 16 dys. **2.** $11\frac{7}{10}$. **3.** 2320. **4.** $5.89. **5.** $40\frac{1}{2}$.

Page 209.

6. $2\frac{1}{12}$ sq. ft. **9.** 139 ft. $11\frac{65}{101}$ in. **12.** $39\frac{13}{83}$ sec.
7. $2\frac{19}{28}$ hrs. **10.** 8. **13.** $34\frac{6}{191}$ sec.
8. 17 ft. $1\frac{1}{14}$ in. **11.** $1\frac{5}{7}$ hrs. **14.** 9 min. $59\frac{1}{2}$ sec.
15. 5 wks. 3 dys. 21 hrs. 20 min. **18.** 1 t. 4 cwt. $45\frac{1}{2}$ lbs.
16. 2673. **17.** $7435.78. **19.** $32\frac{1}{7}$.

Page 210.

20. 0.8 lbs. **23.** $4165. **26.** $8\frac{19}{22}$ mo. **29.** 50.
21. 2565 francs. **24.** 13 yds. **27.** $1\frac{59}{76}$ in. **30.** 21,000.
22. 2306.85 lbs. **25.** $89\frac{103}{193}$ cu. in. **28.** $\frac{5}{16}$ in. **31.** $2\frac{26}{37}$.

Exercise LXIV.

Page 212.

1. $7\frac{1}{2}$.
2. \$26.44.
3. \$23,356.67.
4. 124 lbs.
5. 1368 bu.
6. 14 dys.
7. 540.

Page 213.

8. 6027.
9. \$1.575.
10. 56,875 gals.
11. $188\frac{16}{23}$ yds.
12. 3 hrs.
13. $10\frac{1}{2}$.
14. 38 ft. 1.5 in.
15. 150 yds.
16. $5\frac{29}{47}$ in.
17. 60^{m}.
18. 1134.2776^{kg}.
19. 242.5 cu. ft.
20. 3.8 cu. ft.

Exercise LXV.

Page 215.

1. \$3000, \$4000, \$5000.
2. 150 t., 200 t., 225 t., 240 t.
3. 1155 lbs., 1848 lbs., 3850 lbs.; 3560 lbs., 2225 lbs., 1068 lbs.
4. \$2000; \$1600.
5. 700 lbs.; 21 lbs.
6. $730\frac{43}{50}$ lbs.; $206\frac{7}{50}$ lbs.
7. $37,500^{kg}$ saltpetre, 6250^{kg} charcoal, 6250^{kg} sulphur.
8. $10\frac{2}{3}$.
9. 746.46; 210.54.

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10. $66\frac{2}{3}$ lbs., $33\frac{1}{3}$ lbs.
11. 23.203^{g} oxygen, 76.797^{g} nitrogen.
12. \$45.60.

Exercise LXVI.

1. \$1333.$33\frac{1}{3}$, A's; \$666.$66\frac{2}{3}$, B's.
2. \$863.$28\frac{1}{8}$, \$836.$71\frac{7}{8}$.
3. \$948, A's; \$752, B's; \$816, C's.

Page 217.

4. \$710, A's; \$1196.25, B's.
5. \$882, A's; \$759.50, B's; \$525, C's.
6. \$37.50; \$60; \$35.
7. \$656, A's; \$287, B's.

8. \$1837.50, A's; \$3311, B's.
9. £36 15 *s.*; £14 14 *s.*; £14.
10. \$1811.25, A's; \$1794, B's.

Exercise LXVII.

Page 220.

1. 13,257.
2. 25.55 t.
3. 1500 lbs. saltpetre, 200 lbs. sulphur, 300 lbs. charcoal.
4. 19.2 t.
5. 350.46 cu. ft.
6. 6052.
7. 660.
8. 12%

Page 221.

9. 66.
10. $20\frac{40}{83}$%.
11. $3\frac{51}{83}$%.
12. \$12,500.
13. $1\frac{9}{16}$% loss.
14. $\frac{3}{196}$ of 1%.
15. $6\frac{6}{7}$ t.
16. $5\frac{15}{47}$%.
17. \$2750.
18. 8%.
19. 15%.
20. $7\frac{11}{27}$% water, $92\frac{16}{27}$ alcohol.
21. \$216.
22. $13\frac{41}{43}$%.
23. $9\frac{3}{8}$% gain.

Page 222.

24. \$$3.93\frac{3}{4}$.
25. $7\frac{11}{80}$% gain.
26. \$$4.16\frac{2}{3}$.
27. $6\frac{2}{3}$%.
28. $14\frac{2}{7}$ oz.
29. \$7.50.
30. 5.4 t. silver, 714.6 t. lead.
31. 3038.936 t.

Pages 223–224.

32. 30%.
33. $28\frac{4}{7}$%.
34. $35\frac{5}{17}$%.
35. 100%.
36. $5\frac{5}{19}$%.
37. 3,510,000; 13 : 87.
38. $14\frac{2}{7}$%; $12\frac{1}{2}$%.
39. \$6400; \$7200.
40. 30 cents; $26\frac{2}{3}$ cents.
41. \$143.
42. $99\frac{91}{100}$%.
43. $2\frac{19}{28}$%.
44. $2\frac{14}{23}$%.
45. $2\frac{19}{28}$%.
46. $16\frac{2}{3}$%.
47. 25%.
48. $1\frac{1}{2}$ lbs.
49. 0.00125.
50. $\frac{1}{700}$; $87\frac{1}{2}$ gals. oxygen, 100 gals. nitrogen.
51. 0.00129.
52. $96\frac{116}{129}$.
53. $\frac{7}{74}$ of 1%.
54. $5\frac{31}{37}$ in.

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55. $492\frac{12}{37}$ ft.

Exercise LXVIII.

Page 226.

1. \$13.06. 4. \$40; 2560 bu. 9. \$210.
2. \$64.88. 5. \$5047.64. 7. \$12,445.31. 10. \$6955.56.
3. \$1611.30. 6. $1\frac{1}{2}\%$. 8. \$869.05. 11. \$1.523.

Page 227.

12. $1\frac{691}{700}\%$. 15. \$13,770. 17. \$14,159.25.
13. 6758.6. 16. \$141. 18. $58,536\frac{24}{41}$ lbs.
14. 37,951.2 lbs.; \$128.05. 19. \$195.07; 141.51562 t.

Exercise LXIX.

Page 228.

1. \$13.25. 2. \$56.25. 3. \$1001. 4. \$12,266.67; \$214.67.

Page 229.

5. \$12,000. 8. \$6.25. 11. \$8425. 13. \$96.
6. \$1040. 9. \$363.75. 12. \$97,272. 14. \$1840.
7. \$1836. 10. (1) \$1500; (2) \$750; (3) \$1125; (4) \$1125.

Exercise LXX.

Page 230.

1. \$96.79. 2. \$962,326.53. 3. \$3.866. 4. \$15,306.12.

Page 231.

5. \$6. 7. \$204.80. 9. \$4032. 11. \$1240.70.
6. \$17,818.91. 8. \$1587.60. 10. $28\frac{4}{5}\%$. 12. \$4869.12.
13. \$1781.80.

Exercise LXXI.

Page 233.

1. \$95.94. 2. \$0.13. 3. \$8.46.

Page 234.

4. $183.33.
5. $327.25.
6. $1.60.
7. $12.91.
8. $13.19.
9. $7.56.
10. $3.88.
11. $51.16.
12. $62.04.
13. $37.45.
14. $68.62.
15. $9.46.
16. $28.18.
17. $54.27.
18. $16.69.
19. $50.60.
20. $10.29.
21. $483.28.
22. $487.83.
23. $323.35.
24. $6980.12.
25. $166.98.
26. $548.22.
27. $1268.40.
28. $660.44.
29. $12,474.55.
30. $11,481.45.

Page 236.

31. $4\frac{1}{2}\%$.
32. $4\frac{1}{2}\%$.
33. $4\frac{1}{3}\%$.
34. 6%.
35. 4%, nearly.
36. $3\frac{3}{4}\%$.
37. $4\frac{1}{2}\%$.
38. $4\frac{24}{125}\%$.
39. 4%.
40. 6%, almost.
41. $7\frac{1}{7}\%$.
42. $7\frac{23}{31}\%$.
43. 4%.
44. 4 yrs.
45. 2 yrs.
46. 6 yrs., almost.
47. 3 mos. 9 dys.
48. 25 yrs.

Page 237.

49. 11 yrs. 8 mos.
50. 3 yrs. 4 mos.
51. 3 yrs. 9 mos.
52. 3 mos. 2 dys.
53. 3 yrs. 5 mos.
54. $750.
55. $336.
56. $235.29.
57. $8520.
58. $411.43.
59. $1754.39.
60. $8423.14.
61. $9723.33.
62. $4090.91.

Page 238.

63. $750.
64. $816.896.
65. $5982.55.
66. $286.15.
67. $6050.99.
68. $19,600.
69. $166.
70. $560.
71. $8432.
72. $8520.
73. $27.53.
74. 7%, nearly.
75. 1 mo. 8 dys.
76. $524.10.
77. $22,222.22.
78. 2 yrs. 10 mos. 3 dys.
79. $6\frac{28}{37}\%$.
80. $47.57.
81. 3 yrs. 4 mos. 24 dys.
82. $4.44.
83. $10.20.

Exercise LXXII.

Page 241.

1. May 1/4, 112 dys., $16.33; $733.67.
2. Mar. 4/7, 60 dys., $46.86; $4278.64.
3. Apr. 6/9, 73 dys., $19.03; $1321.67.
4. Apr. 19/22, 2 mos. 21 dys., $16.38; $1439.92.
5. June 2/5, 3 mos. 19 dys., $75.78; $4474.58.

Page 242.

6. Apr. 4/7, 3 mos. 6 dys., $110.46; $5067.46.
7. Apr. 1/4, 48 dys., $47.60; $4712.40.
8. Apr. 14/17, 1 mo. 16 dys., $25.78; $1992.07.
9. June 25/28, 3 mos. 13 dys., $8.61; $660.48.
10. Mar. 20/23, 35 dys., $48.34; $8991.66.
11. Feb. 27/Mar. 2, 27 dys., $0.96¾; $214.03¼.

Page 243.

12. $865.65.
13. $1630.64.
14. $1207.19.
15. $4056.80.
16. $4558.23.
17. $1120.26.

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18. $478.09.
19. $3059.28; $275.34.
20. $3909.48; $351.85.
21. $2348.02; $68.48.
22. $640.
23. $512.65; $61.52.
24. $596.12; $29.01.
25. $683.31; $31.89.

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26. $390.31.

Page 246.

27. $162.31.
28. $283.71.
29. $234.13.

Page 248.

30. \$1547.73. **31.** \$391.01. **32.** \$525.58.
33. \$293.39. **34.** \$17.61.

Page 250.

35. \$433.02.
36. \$703.31.
37. \$195.69.
38. \$3.52.
39. \$24.73.
40. \$40.62.
41. \$303.77.
42. \$125.
43. \$1562.50.
44. \$1441.47.
45. \$1078.43.

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46. \$220.84. **47.** \$245.08.

Page 252.

48. \$3438.32. **49.** \$3569.79; \$3633.04; \$3635.67.

Exercise LXXIII.

Page 254.

1. \$4395.
2. \$2450.
3. \$3046.87$\frac{1}{2}$.
4. \$4723.50.
5. \$1096.87$\frac{1}{2}$.
6. \$11,600.
7. \$4650.
8. \$5200.
9. \$5000.
10. 24.
11. 97$\frac{1}{2}$.

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12. 91$\frac{5}{8}$.
13. \$1188.
14. \$270.
15. \$329.
16. \$30,000.
17. \$9800.
18. \$754.
19. 3$\frac{373}{492}$%.
20. 9%.
21. \$857.14.
22. \$271.19.

Page 256.

23. \$366.15.
24. \$390.
25. 3$\frac{19}{47}$%.
26. 5$\frac{1}{3}$%.
27. 5$\frac{5}{7}$%.
28. 5$\frac{5}{17}$%.
29. 6$\frac{8}{57}$%.
30. 4$\frac{8}{13}$%.
31. 5$\frac{5}{7}$%.
32. \$5635.
33. \$4925.
34. \$5671.
35. 83$\frac{1}{3}$.

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36. 116$\frac{2}{3}$.
37. 133$\frac{1}{3}$; 150; 166$\frac{2}{3}$.
38. 7$\frac{1}{2}$%.
39. \$7291.67.
40. 117$\frac{1}{2}$.
41. 3$\frac{1}{2}$%.
42. 144.
43. \$56.

Page 258.

44. \$13 decrease.
45. \$8 increase.
46. \$100 increase.
47. \$200 increase.
48. \$40 increase.
49. \$5 increase.
50. \$20 increase.
51. \$50 increase.
52. \$10 decrease.
53. \$40 increase.
54. $5\frac{5}{124}\%$.
55. 84.

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56. $\$14.66\frac{1}{4}$.
57. \$5787.46.
58. \$1024.06.
59. $90\frac{1}{2}$.
60. $95\frac{2}{3}$ (nearly).
61. 3%, at 63; $3\frac{1}{2}\%$, at $67\frac{1}{4}$.
62. $113\frac{11}{14}$.
63. $149\frac{1}{6}$.
64. $58\frac{1}{3}$.
65. \$1500 loss.
66. $3\frac{1}{2}\%$, at $91\frac{1}{2}$; $3\frac{353}{549}\%$, $3\frac{151}{183}\%$.
67. \$180 loss.
68. \$10,000.
69. $4\frac{43}{70}\%$.

Exercise LXXIV.

Page 261.

1. \$1102.75. **2.** \$1346.63.

Page 262.

3. \$1595.20.
4. \$491.38.
5. \$1184.30.
6. \$946.08.
7. \$716.85.
8. \$800.52.
9. \$275.52.
10. \$1262.31.
11. \$1138.81.
12. \$519.31.
13. \$10,117.62.

Exercise LXXV.

Page 263.

1. \$1548.14. **2.** \$723.90. **3.** \$2408.01.

Page 264.

4. £413 4*s.* $5\frac{67}{121}$*d.*
5. £28.
6. £821 18*s.* $4\frac{20}{73}$*d.*
7. \$1563.31.
8. \$1945.53.
9. 7672.5 fr.
10. 14,583.4 fr.
11. \$686.65.
12. \$2838.75.
13. $5026\frac{34}{191}$ marks.

Exercise LXXVI.

Page 265.

1. $57\frac{28}{3}$. **3.** \$1.02; \$0.34. **5.** $\$0.30\frac{16}{21}$.
2. $139\frac{13}{70}$ lbs. **4.** $\$0.33\frac{1}{6}$. **6.** \$0.47.

Page 266.

7. 1.256. **8.** 1.171. **9.** 57 : 146. **10.** 4 : 5.
11. 1 : 1 : 5; 1 : 1; 1 : 5; 6 gals.; 8 gals.; $12\frac{1}{2}\%$.

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12. $775\frac{25}{29}$ lead; $224\frac{4}{29}$ tin.

Page 268.

13. 6 mos. 14 dys. **17.** 31 dys., July 22.
14. 57 dys. **18.** 46 dys., Aug. 21.
15. 41 dys. **19.** 6 mos.
16. 94 dys., Aug. 12. **20.** 69 dys., Aug. 19.

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21. Aug. 23, 1881; \$749.93. **22.** July 23, 1881; \$1934.83.
23. May 29, *Dr.* | May 30, *Cr.*

Page 271.

24. June 17, 1879. **26.** Aug. 27, 1880.
25. Mar. 13, 1883. **27.** Dec. 19, 1886.

Page 272.

28. \$38.06. **29.** \$153.44. **30.** \$96.85. **31.** \$22.43.
32. \$110.93.

Exercise LXXVII.

Page 276.

1. 54. **3.** 703. **5.** 1829. **7.** 6879. **9.** 7.33.
2. 89. **4.** 142. **6.** 354.2. **8.** 147. **10.** 29.72.

11. 1.4045. **13.** 1.414213. **15.** 0.547722. **17.** 2.972092.
12. 0.01446. **14.** 2.236067. **16.** 1.802775. **18.** 0.948683.

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19. 311.13. **20.** 12 ft. 3 in. **21.** 8 ft. 11 in.
22. 0.666666; 0.745355; 0.707106; 0.774596; 0.845154; 0.866025; 0.816496; 0.912871.
23. 45; 4.2; 1.42; 23.1; 14.3. **24.** 5 ft. **25.** 91 in.

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26. 60 in. **27.** 25 ft. **28.** 9 ft.

Exercise LXXVIII.

Page 283.

1. 11. **4.** 6.7. **7.** 3.91. **10.** 4.7117.
2. 12. **5.** 53. **8.** 67.31. **11.** 25,805.
3. 2.3. **6.** 127. **9.** 0.1985. **12.** 49.68.
13. 2.1544; 1.5361; 2.0274.
14. 1.7099; 0.8220; 1.9660; 0.9085.
15. 35 sq. ft. 75.84 sq. in.

Exercise LXXIX.

Page 285.

1. 1 : 16; 1 : 64. **3.** 1 : 2; 1 : 4. **5.** 1 : 2.154.
2. 8 : 9261 : 10,648,000. **4.** 1 : 2.121. **6.** 1 : 0.687.

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7. 8.299 ft.
8. 5040 sq. in.
9. 10,648 cu. in.
10. 174.1 lbs.; 6 ft. 4.6 in.
11. 1 : 0.693.
12. 9 : 16; 27 : 64.
13. 3.931 in.
14. 12 ft. 7.19 in.
15. 150 rds.
16. 1 : 0.63.

Exercise LXXX.

Page 291.

1. 0.7781.
2. 1.1761.
3. 1.3222.
4. 1.1461.
5. 1.5441.
6. 0.9542.
7. 0.9030.
8. 1.6902.
9. 1.3980.
10. 1.4771.
11. 1.6232.
12. 2.6232.
13. 1.0791.
14. 1.7781.
15. 1.8751.
16. 0.8751.
17. 8.3222 − 10.
18. 9.5441 − 10.
19. 7.5441 − 10.
20. 7.6020 − 10.
21. 8.6990 − 10.
22. 1.0970.
23. 0.0970.
24. 1.5741.
25. 0.3222.
26. 1.2040.
27. 8.7481 − 10.
28. 9.7993 − 10.
29. 0.2431.
30. 2.0212.
31. 8.0212 − 10.
32. 0.0212.

Exercise LXXXI.

Page 292.

1. 0.9030.
2. 1.3980.
3. 3.3804.
4. 3.8168.
5. 2.5353.
6. 3.4950.
7. 0.1003.
8. 0.3495.
9. 0.0596.
10. 0.1690.
11. 0.1398.
12. 0.0768.
13. 0.2258.
14. 0.4660.
15. 0.2045.
16. 0.2415.
17. 1.1650.
18. 0.3904.
19. 2.9579.
20. 0.6361.
21. 2.4465.
22. 0.4730.
23. 0.5243.
24. 1.3280.
25. 1.1569.

Exercise LXXXII.

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1. 9.6020 − 10.
2. 9.4559 − 10.
3. 9.7781 − 10.
4. 9.6320 − 10.
5. 9.8539 − 10.
6. 0.1461.
7. 0.2219.
8. 0.3980.
9. 0.3680.
10. 0.5441.
11. 0.1761.
12. 1.1461.
13. 8.2219 − 10.
14. 7.3980 − 10.
15. 8.1461 − 10.
16. 1.8539.
17. 2.6320.
18. 6.6320 − 10.
19. 1.2219.
20. 9.5441 − 10.
21. 0.4559.
22. 8.8539 − 10.
23. 7.6320 − 10.
24. 7.5441 − 10.
25. 5.1707 − 10.
26. 4.8293.
27. 5.9333.
28. 4.1040.
29. 2.8627 − 10.
30. 7.1373.

Exercise LXXXIII.

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1. 1.8451.	**13.** 2.8638.	**25.** 966.	**37.** 0.6910.
2. 2.0043.	**14.** 7.9428 − 10.	**26.** 34,580.	**38.** 48.67.
3. 2.5224.	**15.** 0.9074.	**27.** 7.162.	**39.** 47.58.
4. 3.5429.	**16.** 0.6991.	**28.** 0.9982.	**40.** 2.349.
5. 3.2709.	**17.** 9.5762 − 10.	**29.** 0.0540.	**41.** 3.721.
6. 3.8386.	**18.** 8.8494 − 10.	**30.** 0.3593.	**42.** 61.21.
7. 3.9957.	**19.** 8.5709 − 10.	**31.** 0.0001051.	**43.** 0.6137.
8. 3.6424.	**20.** 1.9951.	**32.** 0.001019.	**44.** 464.9.
9. 3.0457.	**21.** 7974.	**33.** 416.	**45.** 212.4.
10. 4.7660.	**22.** 16.13.	**34.** 0.1549.	**46.** 0.8168.
11. 4.8913.	**23.** 2.781.	**35.** 2.559.	
12. 4.4790.	**24.** 10.21.	**36.** 165.	

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47. 4.324.	**55.** 129.6.	**63.** 0.4876.	**71.** 2.351.
48. 0.2783.	**56.** 97.84.	**64.** 0.006134.	**72.** 1.961.
49. 0.001569.	**57.** 43.8.	**65.** 17.76.	**73.** 1.97.
50. 3889.	**58.** 5.153.	**66.** 669.9.	**74.** 0.8834.
51. 0.0006324.	**59.** 0.2061.	**67.** 29.76.	**75.** 9.683.
52. 0.06523.	**60.** 0.7285.	**68.** 70.37.	**76.** 13.13.
53. 13.28.	**61.** 0.0005336.	**69.** 167.1.	**77.** 4.391.
54. 2.684.	**62.** 0.629.	**70.** 1.838.	**78.** 0.8578.

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79. 2.534^{kg}. **80.** 148.5 sq. in. **81.** 54.44 in.
82. 5.504 in.

Exercise LXXXIV.

Page 303.

1. 2.3028.	**4.** 0.268; 3.732.	**7.** 8.272.	**10.** 1.8117.
2. 22.11 ft.	**5.** 1.3713.	**8.** 2.8541.	**11.** 1.186.
3. 6.828 +; 1.17 +.	**6.** 2.8284.	**9.** 9.1231; 0.8769.	**12.** 2.796.

Exercise LXXXV.

Page 306.

1. $\cfrac{1}{3+\cfrac{1}{1+\cfrac{1}{2}}}$ $\quad$ $\cfrac{1}{5+\cfrac{1}{1+\cfrac{1}{3+\cfrac{1}{2+\cfrac{1}{9+\cfrac{1}{7}}}}}}$ $\quad$ $\cfrac{1}{4+\cfrac{1}{2+\cfrac{1}{1+\cfrac{1}{1+\cfrac{1}{1+\cfrac{1}{3}}}}}}$

2. 1, $\frac{2}{3}$, $\frac{3}{4}$; 1, $\frac{8}{7}$, $\frac{9}{8}$; 1, $\frac{6}{7}$, $\frac{19}{22}$, $\frac{25}{29}$, $\frac{44}{51}$, $\frac{69}{80}$.

3. $\frac{1}{4}$, $\frac{4}{17}$, $\frac{17}{72}$, $\frac{21}{89}$; $\frac{1}{4}$, $\frac{4}{17}$, $\frac{17}{72}$, $\frac{293}{1241}$; 2, $\frac{3}{2}$, $\frac{5}{3}$, $\frac{8}{5}$, $\frac{29}{18}$, $\frac{37}{23}$.

4. $\frac{1}{2}$, $\frac{1}{3}$, $\frac{2}{5}$, $\frac{3}{8}$, $\frac{5}{13}$, $\frac{8}{21}$, $\frac{13}{34}$, $\frac{21}{55}$, $\frac{34}{89}$; 2, $\frac{5}{3}$, $\frac{7}{4}$, $\frac{19}{11}$, $\frac{26}{15}$, $\frac{71}{41}$, $\frac{97}{56}$, $\frac{168}{97}$; 1, $\frac{1}{2}$, $\frac{2}{3}$, $\frac{257}{411}$, $\frac{262}{419}$, $\frac{781}{1249}$.

5. $\frac{1}{2}$, $\frac{1}{3}$, $\frac{3}{8}$, $\frac{55}{147}$; 1, $\frac{4}{5}$, $\frac{13}{16}$, $\frac{17}{21}$, $\frac{149}{184}$; 1, $\frac{6}{7}$, $\frac{7}{8}$; 8, $8\frac{1}{3}$, $8\frac{2}{7}$, $8\frac{5}{17}$, $8\frac{7}{24}$.

6. $\frac{709}{1640}$.

7. 1, $\frac{4}{5}$, $\frac{5}{6}$, $\frac{9}{11}$, $\frac{14}{17}$, $\frac{65}{79}$.

8. 1, $\frac{2}{3}$, $\frac{5}{7}$, $\frac{12}{17}$, $\frac{29}{41}$, $\frac{70}{99}$.

9. $\frac{1}{4}$, $\frac{21}{85}$, $\frac{64}{259}$.

10. 1, $\frac{9}{10}$, $\frac{10}{11}$, $\frac{39}{43}$.

11. 1, $\frac{1}{2}$, $\frac{8}{15}$, $\frac{9}{17}$.

12. 1, $\frac{3}{4}$, $\frac{13}{17}$, $\frac{250}{327}$.

13. 1, $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{5}$, $\frac{5}{8}$, $\frac{18}{29}$, $\frac{59}{95}$.

Exercise LXXXVI.

Page 308.

1. 15.
2. 72.
3. $5\frac{4}{7}$.
4. $25\frac{3}{4}$.
5. 9.
6. $10\frac{2}{3}$.
7. 32, $43\frac{1}{4}$.
8. 5.
9. $6\frac{2}{3}$.
10. $1\frac{4}{5}$.
11. 1.1.
12. 6.

Exercise LXXXVII.

Page 309.

1. 780.
2. 74.
3. 88.
4. $103\frac{1}{4}$.
5. 210.
6. 765.
7. 1200.
8. 507.
9. 575.
10. 209.3 ft., 788.9 ft.
11. 32 mi.
12. $5\frac{5}{8}$ mi.

Exercise LXXXVIII.

Page 311.

1. 4374.
2. $\frac{1}{2}$.
3. $22\frac{25}{32}$.
4. $\frac{128}{243}$.
5. $2441\frac{13}{32}$.
6. 7, 14, 28.
7. 248.832.
8. $1464.10.
9. $1338.12 (*by logs*); $1338.23 (*exact*).

Exercise LXXXIX.

Page 313.

1. 728.
2. 511.
3. 363.
4. $98\frac{33}{64}$.
5. $1\frac{1093}{2187}$.
6. $1\frac{511}{512}$.
7. $1\frac{1931}{4374}$.
8. 11,718.
9. $4\frac{364}{729}$.
10. $7254.40 (*by logs*); $7253.13 (*exact*).

Exercise XC.

Page 314.

1. 1.
2. 2.
3. $\frac{1}{3}$.
4. $\frac{1}{4}$.
5. $\frac{17}{99}$.
6. $\frac{21}{99}$.
7. 1.
8. $\frac{23}{99}$.
9. $\frac{3648}{9900}$
10. $\frac{1512}{9900}$

Exercise XCI.

The logarithm of a power, obtained by multiplication, is necessarily liable to an error in the last place, which may equal half the exponent. A result thus obtained from 4-place logarithms may therefore be uncertain in the fourth significant digit.

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1. $82.08.
2. $173.
3. 11.8 yrs.
4. 18.9 yrs.
5. 4.38 yrs.
6. 14.29 yrs.
7. 5.95%.
8. 7.6%
9. 4.1%
10. $852.80.
11. $1352; $3656.
12. $1197.50.

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13. $1227.80. **15.** $2428. **17.** $2376.
14. $4818. **16.** $2647. **18.** $2418.

CHAPTER XXV.

MISCELLANEOUS PROBLEMS.

Page 318.

1. 123, 132, 213, 231, 312, 321; 1332.
2. 235, 253, 325, 352, 523, 532; 1,892,000,000,000,000; (*by logs*).
3. 873, 837, 783, 738, 387, 378; 61,770,000,000,000,000; (*by logs*).
4. 2.093; 2.987; 3.741; 8.984; (*by logs*).
5. 0.4309; 13.98; 2.801; 1102.5; (*by logs*).
6. 201.1; 4.39; (*by logs*). **8.** 5268.585 ft. **10.** 29.67.
7. 1533.623 ft. **9.** 808.97 ft. **11.** 55.31.

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12. P. 200; C. 101; B. 189.
13. $432 = 54 \times 8$; $4+3+2=9$; $3+4+2=6+3$.
14. 196. **15.** $\frac{1099}{1443}$. **19.** 7974 dys.
16. $\frac{11}{10}$, $\frac{12}{11}$, $\frac{35}{32}$, $\frac{257}{235}$. **20.** 12 ft.
17. 25, 9, 49; 225, 1225, 441, 11025. **21.** 3 mi. 160 yds.
22. 38 barges.
18. 92 ft.

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23. 458.49^{l}; 13. bu. **29.** 146 balls (*by logs*).
24. 2803.194^{kg}. **30.** 0.00336 in.
25. 1.3939 t. **31.** 7 dwt. 21 gr.
26. 1052.09 sq. in. **32.** $2250.
27. 7.407 A. (*by logs*). **33.** 15 cts. per lb.
28. 523.6; 4188.8; 1 : 8. **34.** $13.85, $8.85, $4.42½.

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35. 12,480.
36. \$15 a year.
37. $17\frac{1}{2}$ min.
38. $12\frac{1}{2}$ min.
39. 15.2498; 15.25; (*by logs*).
40. A gains \$5.05.
41. 905 t. 1392 lbs.
42. 46.37 sq. in.
43. $28\frac{4}{17}$.
44. 9 men.
45. 30 sq. in.

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46. 1367 sq. ft. (*by logs*).
47. 0.1467^{ha} (*by logs*).
48. 0.2736^{ha} (*by logs*).
49. 0.8908 A. (*by logs*).
50. 224.3 A. (*by logs*).
51. 25.12 sq. rds. (*by logs*).
52. 3.946 A. (*by logs*).

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53. 0.194167^{ha}.
54. 0.6436 A.
55. 866.0254 ft.
56. 13.2^{mm}; 17.62^{mm}; 23.36^{mm}.
57. 61,785 sq. ft. (*by logs*).

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58. Diagonal, 351.489 ft.; area, 61,785 sq. ft. (*by logs*).
59. 314.16 sq. in.; 78.54 sq. ft.; 71.62 sq. in.
60. 0.2428^{ha}.
61. 2205.5 sq. ft. (*by logs*).
62. 9804 sq. ft. (*by logs*).
63. 1922.9 sq. in.
64. 50.2656 sq. in.
65. 523.6 cu. in.
66. Diam., 5.57 ft.; area, 24.37 sq. ft. (*by logs*); sphere, 90.52 cu. ft. (*by logs*).
67. Iron, 38.86^{kg}, 85.66 lbs.; tin, 8.383^{kg}, 18.48 lbs.; lead, 30.76^{kg}, 67.83 lbs.; silver, 0.01233^{kg}, 0.02717 lb.; (*by logs*).
68. 898 balls of a diameter 2.436 in. (*by logs*).

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69. 3737.5 lbs. (*by logs*).
70. Weights: 482.24^{mg}, 482.24^{g}, 482.24^{kg}; surfaces: 3.1416^{qcm}, 314.16^{qcm}, $31,416^{qcm}$. The first, if we take no account of the retardation of the air by friction on the plane.

71. End, 78.54 sq. in.; convex surface, 376.99 sq. in.; total surface, 534.07 sq. in.; contents, 4.08 gals.; (*by logs*).

72. 8935 gals. (*by logs*).

73. 5.424 in. (*by logs*).

74. 552.92 cu. in.

75. 6.65 in.; 4.19 in.; 10.84^{cm}; (*by logs*).

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76. 31.952 cu. in.

77. 50.93 bu.

78. $59{,}259\frac{7}{27}$ cu. yds.

79. $66{,}966\frac{2}{3}$ cu. yds.

80. 15.09 cu. in.

81. $2{,}614{,}689^{cbm}$.

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82. 0.14067^{l}.

83. 98.47^{cm} radius.

84. 1.833^{l}.

85. 112.07^{l}.

86. 3.302 qts.

87. 0.796 pt.; 2.489 pts.; 3.825 pts.

88. 178.3 gals.

89. 22.286 gals.

90. 0.249 pt.; 0.963 pt.; 2.002 pts.; (*by logs*).

91. 4.596 pks.; 0.531 pk.; 4 pks.; (*by logs*).

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92. 10 ft.; 20 ft.

93. 235.5; 706.5 ft.; (*by logs*).

94. 112.8^{m}; 564^{m}; (*by logs.*)

95. 25.

96. 261.8 cu. in., a little over 9 pts.

97. $78.54.

98. 633 million million million bu.; 458 hundred thousand million yds.; (*by logs*).

99. 8 billion cu. mi. (*by logs*).

100. "2 feet square" means a square 2 ft. on a side; "2 square feet," any surface equivalent in area to two squares each 1 ft. on a side. A "foot square" is a square; while a square foot is an equivalent area in any shape. "Half a foot square" is ambiguous. Half "a foot square" is half a square foot, while "half a foot" square is 6 in. square; that is, is one-fourth a square foot.

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101. $25\frac{1}{3}$ cu. ft. **103.** 210.54^{hl}.

102. 4.42 qts. **104.** 69.115 sq. in.; 247.401 sq. in.

105. 30 ft.; 100 ft.; 60 ft.; 4712.4 sq. ft.

It is plain that the kid can go 10 ft. beyond each stake on a line joining them, so that her range is 100 ft. long. When she is at the middle of the cord, and draws it taut, imagine a stone midway between the stakes. The stone, the kid, and either stake then make a triangle, right-angled at the stone; and $50^2 - 40^2 = 900 = 30^2$, so that the kid is 30 ft. from the stone; the width of her range is therefore $2 \times 30 = 60$ ft., and its area 4712.4 sq. ft.

106. $61\frac{3}{10}\%$.

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107. 11 in.; 13.603 (*by logs*); 117.5 sq. in. (*by logs*).

108. 9.784 in.; 2.446 in.

The law of § 452 may be put: The length of pendulums is inversely as the square of the number of their vibrations in a given time. Therefore, a half-seconds pendulum will be $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$ the length of a seconds pendulum; and a quarter-seconds pendulum, $\frac{1}{4} \times \frac{1}{4} = \frac{1}{16}$ the length. It will be understood that these lengths, 39.138, 9.784, 2.446 inches, refer to the theoretical case in which the rod is without weight and all the weight on the end; or they are the distance apart of two points in a bar of uniform thickness and weight from end to end, at either of which the rod would vibrate at the required rate.

109. 55.92^{cm}; 397.64^{cm}. **110.** 8.17 times.

111. $1{,}000{,}000^{kg}$.

Suppose the plunger and piston square: the one would press on a surface of 1^{qcm}, the other on a surface of $10{,}000^{qcm}$. By driving the plunger in 10^{cm}, you force 10^{ccm} of water under the piston. But, as this is spread under $10{,}000^{qcm}$, you raise the piston thereby only 0.001^{cm}; that is, only 0.0001 part of the way you move the plunger. Hence, by the principle of virtual velocity (what is lost in time is gained in power), you lift the piston with 10,000 times your force of 100^{kg} applied. The lifting power, in other words, is $1{,}000{,}000^{kg}$, or 1000^{t}, minus the trifling loss by friction.

112. 9,216,000 lbs. **113.** 144,000 lbs.

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114. 114 t.; 6 t.; 600 t. **115.** $56\frac{1}{4}$ t. of 2000 lbs.

116. 7.355^m; 31.869^m per sec.

As the velocity is in proportion to the time, the velocity in $\frac{3}{4}$ of a second will be $\frac{3}{4} \times (9.806^m)$, that is, $\frac{3}{4} \times (32.172 \text{ ft.}) = 24.139$ ft.; in $3\frac{1}{4}$ seconds it will have a velocity of $3\frac{1}{4} \times 32.172 = 104.56$ ft. per second; that is, that will be its rate at that instant, but the velocity steadily increases. In the first tenth of a second a stone falls 0.1609 of a foot, but has already acquired a velocity that would carry it 3.217 of a foot in a second. In the next tenth of a second it goes, therefore, by that velocity 0.3217 ft., and, by still falling, 0.1609 more, so that it has gone 0.4826 of a foot; and its velocity is its old one and 3.217 added, that is, 6.217 feet. In other words, the falling body cannot fall so fast as to lessen its weight; its weight constantly accelerates its motion.

117. 0.3876 sec. (*by logs*).

118. 198^m per sec.; 20.19 sec. (*by logs*).

119. 651.8 ft. per sec.; 20.26 sec. (*by logs*).

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120. 3.81 sec.

The acceleration 32.172 is for a vacuum, 32 ft. is near enough for practical questions; and 16 ft. for the fall. $\sqrt{210} \div \sqrt{16} = 3.623$ sec. will therefore give the time of falling. To this add $\frac{210}{1120}$ for the sound to come up, and we have the answer 3.811 sec.

121. 11.428 sec. **122.** 747 ft. **123.** 133 ft.

124. 0.04515 sec.; 0.07198 sec.; 0.1428 sec.; 0.17635 sec.

125. 24 ft. per sec.

The velocity will be to 32 ft. as $\sqrt{9}$ is to $\sqrt{16}$; that is, it will be 24 ft. a sec. This law is obtained from experiment.

126. 40 ft. and 80 ft. per sec. **127.** 15 gals. an hour.

128. $6\frac{1}{4}$ gals.

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129. 3 gals. to area; 3 pts. to friction.

130. $3\frac{3}{8}$ as much; $15\frac{5}{8}$ as much.

131. 6135 times the weight of the material.

Three inches in diameter is 1.5 in. or $\frac{1}{8}$ ft. radius. Therefore, by the formula, the outer layer of the top will pull out with

$1.227 \times \frac{1}{8} \times 200 \times 200 = 6135$ times the weight of the material.

132. 5.453 times its weight when on a level with the hand; 4.453 times when highest; 6.453 times when lowest.

As this circle is vertical, the weight of the stone acts alternately with and against the centrifugal force; so that, on a level with the hand, it pulls (by the formula) with 5.453 times its weight; but at the highest point with 4.453, and at the lowest with 6.453 times.

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133. With 0.0752 of its weight.

30 mi. per hour is 44 ft. per sec. A circumference of 800 ft. radius measures 5026.55 ft., nearly. The force is therefore $1.227 \times 800 \times \left(\frac{44}{5026.55}\right)^2 = 0.0752$ of its weight.

134. 21.735 times its weight. **135.** 186.116 times its weight.

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136. $\frac{1}{4}$ lb.; 1 lb.

18 in. $= \frac{1}{2}$ yd., and $\frac{1}{2}$ yd. of chain $= \frac{1}{4}$ lb. weight. Therefore, $\frac{1}{4}$ lb. and 1 lb. are the answers.

137. 100 yds.

The horizontal tension is 25 lbs., which represents 100 yds. of rope. Hence, radius = 100 yds.

138. $71\frac{3}{7}$ yds.

The weight of the rope being $\frac{140}{100} = \frac{7}{5}$ of what it was, it takes only $\frac{5}{7}$ of 100 yds. $= 71\frac{3}{7}$ yds.

139. 2145 lbs.

1980 ft. = 660 yds., and $3\frac{1}{4} \times 660 = 2145$ lbs. tension. *Ans.*

140. $\frac{1}{8}(19.5 \times 11.5) = 28.031$ ft.

Half-chain = 15.5 ft., sag = 4 ft.; sum of half-chain and sag = 19.5, diff. = 11.5. Therefore, by Prop. II., radius $= \frac{1}{8}(19.5 \times 11.5) = 28.031$.

141. $\frac{18}{31} \times 28.031 = 16.27$ lbs.; by III., log $\frac{1}{2}$ span = log 19.5 + log 11.5 + log (1.2900 − 1.0607) + colog 4 + 0.0612; whence span = 29.58; batter = 1.808.

The chain weighs $\frac{18}{31}$ lb. to a ft., and the tension is therefore $\frac{18}{31}(28.031) = 16.27$ lbs. By Prop. III., log $\frac{1}{2}$ span = log 19.5 + log 11.5 + log(1.2900 − 1.0607) + colog 4 + 0.0612. Whence span = 29.58 ft. By Prop. IV., batter = $\frac{28.031}{15.5} = 1.808$.

142. Radius, 91.75^{m}; tension, 91.75^{kg}; span, 30.85^{m}; batter, 5.92; depression at 10^{cm} from ends, 1.689^{cm}.

Half-chain = 15.5^{m}, sag = 1.3^{m}; therefore, by Prop. II., radius = $16.8 \times 14.2 \div 2.6 = 91.75^{m}$, and (by Prop. I.) tension = 91.75^{kg}. By Prop. III., log $\frac{1}{2}$ span = log 16.8 + log 14.2 + log (1.2253 − 1.1523) + colog 1.3 + 0.0612. Whence span = 30.85^{m}. By Prop. IV., batter = $\frac{91.75}{15.5} = 5.92$. 10^{cm} now becomes hypotenuse to a right triangle whose legs are in the proportion 1 : 5.92; and the square of 10 = 100 is to be divided in the proportion $1^2 : 5.92^2 = 1 : 35.05$. The smaller of these parts, 2.773, is the square of 1.665^{cm}, the depression required. The advantage of logs is here especially manifest. Log $\frac{100}{35.05} = 2 - \log 35.05 = 0.4553$; one-half of which is 0.2277, which is log 1.689.

143. Suppose the sag 26.5^{m}: it gives, by III., half-span 40.05; suppose the sag 26.6^{m}, it gives half-span 39.95, whence sag is 26.55, as nearly as four-place logs can get it. Batter, 0.676; tension, 97 lbs. or 44^{kg}.

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144. By position and Prop. III., sag = 22.55^{m}, and tension = 111.3 lbs.

145. By position and Prop. III., 120.95 ft.; 109.96 ft.; 102.6 ft.

146. 1750 gr.; (1728 ÷ 4) × 16 = 6912, and sp. gr. = 6.912.

147. 3.578 in.; 6.253 in.

148. 66.45 lbs.; 7.673 in.

149. 515.67 lbs.; 15.19 in.

150. 7.312 in.

2 gals. are 462 cu. in. Therefore, $\frac{1}{11} \times 462 = 42$ sq. in. is the area of the end of the cylinder. As log diam.^{2} + log 0.7854 = log 42, we have 2 log diam. = log 42 − log 0.7854, or log diam. = $\frac{1}{2}$ (1.6232 + 0.1049) = 0.8640, and diameter = 7.3117 inches.

151. 8.084 in. **153.** 6.2832^{cm}. **154.** 48 ft.

152. 20.6^{cm}. **155.** 530.7 times.

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156. 4.22 times its weight.

The carriage going at 10 mi., the top of the wheel goes at 20 mi., or $29\frac{1}{3}$ ft. per second. The radius of the curve is $6\frac{1}{3}$ ft., the total circumference of which would be $12\frac{2}{3} \times 3.1416 = 39.7936$ ft. The force, therefore, is

$$1.227 \times 6\tfrac{1}{3} \times \left(\tfrac{29.3333}{39.7936}\right)^2 = 4.224 \text{ times its weight.}$$

157. In going one mile the wheel turns 530.7 times. Therefore the point travels $3\frac{1}{6} \times 4 \times 530.7 = 6722.2$ ft.

158. 2.776^l.

A square shaft to enclose the neck would contain $6 \times 6 \times 7.5 = 270^{ccm}$; one to enclose the body would contain $13 \times 13 \times 15.3 = 2585.7^{ccm}$. A square frustum would have its bases 6×6^{qcm} and 13×13^{qcm}, and the square root of their product would be 6×13^{qcm}. Add the three and multiply by $\frac{1}{3}$ of 7.2^{cm}, gives 679.2^{ccm}. The three solids added make 3534.9^{ccm}, which, multiplied by 0.7854, to reduce it from square to round form, gives $2776.3^{ccm} = 2.776$ for the contents.

159. 1.25^l.

Proceed as in 158. The cylinder holds $1.6^2 \times 8 \times 0.7854^{ccm}$. The frustum $\frac{14}{3}(17.5^2 + 1.6^2 + 17.5 \times 1.6) \times 0.7854^{ccm}$; and the sum of the two is 1.25^l.

160. 2.4845^l. **161.** 33,072.6^{qcm}; 25.7967^{kg}.

162. Cap. 7.607^l; weight, 68.71^{kg}.

The cavity is $32 - 2 \times 3.8 = 24.4^{cm}$ in diameter; and 3 times log 24.3 + log 0.5236 gives log of contents in cubic centimeters, that is, 7.607^l. The exterior size is $32^3 \times 0.5236^{ccm}$; subtracting cavity, and multiplying by 7.2, gives 68.71^{kg} as the weight.

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163. 673.6^{qcm}.

On every side imagine a multitude of straight lines going straight up the shade. The space between any two would be measured by the product of its length, 13.4^{cm}, and its average breadth, or breadth in the middle. But these middle breadths constitute a circumference round the shade, with a diameter $\frac{1}{2}(25 + 7)$. Therefore the curved surface is $13.4 \times 16 \times 3.1416 = 673.6^{qcm}$.

164. 368.61^{l}; 2.26195^{qm}.

The volume of the half-cylinder $= \frac{1}{2}(0.8^2 \times 0.7854 \times 1.2)$. That of the half dome is $\frac{1}{4}(0.8^3 \times 0.5236)$, and the sum of the two $= 368.61^{l}$. The area of the floor is $\frac{1}{2}(0.8^2 \times 0.7854)$; of the wall, $\frac{1}{2} \times 0.8 \times 3.1416 \times 1.2$; and of the roof, $\frac{1}{4} \times 4 \times 0.8^2 \times 0.7854$; the sum being 2.26195^{qm}.

165. 9.8855^{hl}.

The cylinder is $3.4^{m} \times 0.8^2 \times 0.7854$. The two caps would make a sphere, $0.8^3 \times 0.5236$. Half the sum is 9.8855^{hl}.

166. 21.04 mi. **167.** 23.66 mi.

168. 67.8 mi.

The sailors' offing is $\sqrt{52.5}$ miles toward the coast, and $\sqrt{40{,}250}$ miles from Aconcagua; therefore, $200.6 - 140 = 60.6$ from the coast, and the ship is $60.6 + 7.25 = 67.85$ miles from land.

169. 28.5 mi.

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170. 21,110 A. (*by logs*).
171. 229 mi.; 93.5 mi.; 41.8 mi.
172. 1429 ft.; 5714 ft.; 12,860 ft.
173. 122.5^{km}; 173.2^{km}.
174. 12.85^{km}.
175. 1950^{m}.
176. 8475 ft.
177. 53.88 mi.

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178. 2.5946^{km}; 87.1667^{km}.
179. 16 h. 3.2 min.
180. 30.63^{km}.
181. 2.79 mi.
182. 14.16 sec.
183. 0.67 sec.; 7.07 sec.

184. 6.93; 7.13 sec. sound; 8.02; 9.68 sec., balls; (*by logs*).

The wind at 11 mi. an hour goes 16.1 ft. a second, which must be added to the velocity of the sound for one gunner, and subtracted for the other.

185. 7.18 sec.

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186. $34.125. **187.** $22\frac{2}{29}$ min.

188. 126,233.8 gals.

As the canal slopes only on its sides, not at its ends, the capacity is the same as if its top and bottom were each $7\frac{1}{2}$ yds.

$$50 \times 7.5 \times \tfrac{5}{3} = 50 \times 12.5 = 625 \text{ cu. yds.}$$

189. A, 70.5; B, 45.5 lbs.

190. $51\frac{3}{7}$ min.

The man rows 4 mi. an hour for 1.2 hours; that is, rows 4.8 mi., but only makes 4 mi. Therefore, the current bears him down 0.8 mi. in 1.2 hours, or flows at $\frac{2}{3}$ mi. per hour. When he rows with it he will therefore go $4\frac{2}{3}$ mi. per hour, and row 4 mi. in $\frac{6}{7}$ hour $= 51\frac{3}{7}$ min.

191. 40.8 ft. **193.** 852.64 sq. in.

192. $12\frac{9}{10}$ carats; 15 carats. **194.** 8.12 in.

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195. 203,996 shot.

The cylinder would hold 785.398 cu. in. Reduce 0.3927 cu. ft. to inches by multiplying by 1728, and subtract from 785.398. The remainder is what is lacking; and this divided by $0.1^3 \times 0.5236$, that is, by 0.0005236, will give the number of shot.

196. 2.353 in.

$\frac{1}{60}$ of 231 is 3.85 cu. in., the capacity of a glass. $2.5 \times 2.5 \times 0.7854$ will be the area of the top. Divide the capacity by the top area, and the quotient is $\frac{1}{3}$ the depth.

197. 1 min. 9.58 sec.

The train is 72 sec. in passing from one signal to the other. When it reaches the second signal, the sound of the first signal is therefore $72 \times 1090.2 - 2640$ ahead of it; and this distance, divided by 1090.2, is 72 sec. $- 2.422 = 69.578$ sec., the required interval.

198. 20.71; 29.29 yds.

The square of one distance is twice the square of the second; the distances must therefore be in the proportion $1 : \sqrt{2}$, or $1 : 1.4142$ and $2.4142 : 50 = 1$: smaller distance.

199. 5.366 ft.; $\frac{6400}{6743}$; (*by logs*).

The cubical cistern holds 64 cu. ft., and requires $5 \times 16 = 80$ sq. ft. of lead to line it.

The round cistern will require 16×0.7854 sq. ft. on the bottom. Subtract this from 80 sq. ft., and divide by 4×3.1416, and you have the permitted depth. Multiply this by the area of the bottom for the capacity.

200. $12.60. **202.** $96\frac{3}{7}$ nights.
201. 192.2 mi. **203.** 22.015 in.

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204. 1 long ton; 2400 lbs. **205.** 9 ft.; 7 ft. **206.** 8 oz.
207. 6 lbs.

The substance being in the left pan, requires 9 lbs. in the right to balance it. But 4 lbs. in the left pan required the substance in the right. That is, 4 lbs. is to the substance as the substance was to 9 lbs.; and, by the rule of three, 4×9 = true weight squared. Hence the substance weighs 6 lbs.

208. 181.82 lbs. **209.** 17.68^{kg}.

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210. Less than 144 lbs. **212.** $88\frac{8}{9}\%$ O; $11\frac{1}{9}\%$ H.
211. Less than 0.754 in. **213.** $28\frac{4}{7}\%$.
214. 24.32%.

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215. 48%. **219.** 23.46 oz. **223.** $83\frac{1}{3}$ grs.
216. $18\frac{26}{43}\%$. **220.** $52\frac{4}{23}\%$; 12%. **224.** 960^{mg}.
217. $4\frac{28}{143}\%$. **221.** 40%. **225.** 40^{kg}.
218. 187.6 oz. **222.** 7.83 lbs. **226.** $11{,}052.6^{g}$.
227. 6530.6^{g}. **228.** 18.37% water; 81.63% sulphuric acid.
229. $2722\frac{2}{9}^{mg}$. **230.** Fe_2O_3. **231.** SO_2.

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233. C_5H_8; $11\frac{13}{17}\%$.

234. 90.

The numbers actually formed are those from 10 to 99; 90 in all. To show how many *can* be formed, consider that each digit may be followed by itself or by either of the other 9, giving 100 sequences of 2 figures; but 10 of these begin with naught, and are to be rejected, leaving 90.

235. 45.

As 10 is even and 99 odd, one-half the 90, — viz., 45, — is odd.

236. 648.

The digit in the thousands' place must be either 1, 2, or 3. Either of these may be followed in the hundreds' place by either of the 6 given digits, making 18 different hundreds. Each of these may be followed in the tens' place by either of the 6, giving 108 different tens; each of which may have 6 digits, giving 648 numbers if you include the 1000.

237. 55.

By a dominoe is meant two numbers, side by side. Double-blank is 0 0. The next pieces introducing 1 are 0 1, 1 1; those introducing 2 are 0 2, 1 2, 2 2. Every number introduced requires new pieces exceeding by one the number introduced. Thus, as we have seen that to go to double-2 requires 6; to go to double-3 will require $6 + 4 = 10$ pieces; double-4, $10 + 5 = 15$ pieces. The ordinary set is $15 + 6 + 7 = 28$ pieces; and for double-9's we should require $28 + 8 + 9 + 10 = 55$ pieces.

238. 31.

With a single piece, 5 amounts; with 2 pieces, $4 + 3 + 2 + 1 = 10$ amounts; with 3 pieces, 10 amounts; with 4 pieces, 5 amounts; with all 5 at once, 1 amount; with the 5 in their various combinations, therefore, $5 + 10 + 10 + 5 + 1 = 31$ amounts.

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